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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

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PART I, No. 5.

GASTEROPODA OF THE INFERIOR OOLITE.

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spire is sub-turrited or step-like. Lower down this feature disappears, and the whorls succeed each other without any prominence, except that, in well-preserved specimens, a slight posterior marginal rim may be noted on one or two of the latest whorls. Lines of growth may be observed in the later whorls of such a specimen as fig. 8 *a*, otherwise no traces of ornament have been discovered.

The aperture is subrhomboidal, and, as in the case of *Ptyg. Cotteswoldiæ*, bears no trace of the presence of folds when the shell is complete (fig. 8 *a*). On the other hand, when the shell is fragmentary (fig. 8 *b*) the aperture exhibits three folds on the columella, and one on the outer wall. The *section* shows five folds in all, two on the outer wall and three on the columellar side, of which the upper one may be regarded as being in the posterior wall. These folds are large and complex, and must have reduced the available space, the result being a whimsical figure.

Relations and Distribution.—*Ptygmatis Santonis* belongs to the *Cotteswoldiæ*-group, but differs in the absence of the fourth fold on the columellar side. It is also narrower than the majority of specimens of *Ptyg. Cotteswoldiæ*, and the whorls are relatively higher. It may possibly represent *N. triplicata*, Voltz. based on the cast of a *Ptygmatis* too imperfectly diagnosed to be accepted as a species.

Occurs in the Lincolnshire Limestone at Santon, and very rarely in the marly Oolite of Longridge.

163. Nerinæa (*Ptygmatis*) brevivoluta, sp. nov. Plate XVI, figs. 9 *a*, 9 *b*, and ? 10.

Description:

Spiral angle (regular)	12°—14°.
Height of whorl to width . . .	1 : 2·2.
Length	35 mm.

Shell conical, slightly turrited, apex acute. Whorls about twenty-one, extremely short. In the apical region the sutural belts are thick and prominent, in the later whorls they are well defined but thinner, and the whorls themselves are slightly excavated. No trace of ornamentation has hitherto been noted.

Body-whorl short and angular; aperture angular and more wide than high; canal but little reflexed. The *section* shows five folds, two on the outer wall, three on the columellar side. Owing to the large size and complex nature of three of these folds (fig. 9 *b*), the interior space was very much restricted. The anterior fold on the outer wall might sometimes be construed as two folds.

Relations and Distribution.—*Ptyg. brevivoluta* belongs to the *Cotteswoldiæ*-group,

its section partaking of the whimsical character of that abundant species, though, like *Ptyg. Santonis*, it possesses only three folds on the columellar side. It is easily distinguished from all other species of *Nerinæa* previously described in this Monograph by the excessive shortness of the whorls. The width of a whorl is equal to its height *plus* the height of the preceding one, *plus* half the height of the next preceding one.

Found in considerable numbers in the *Clypeus*-grit of Barrington, in the Cotteswolds, and noted also on the same horizon at Twerton Hill, near Bath.

A fragment from the Lincolnshire Limestone of Weldon (fig. 10) presents similar proportions, and may at least represent a variety.

164. Nerinæa (*Ptygmatis*), species or variety. Plate XVI, fig. 11.

Description:

Spiral angle	12°.
Height of whorl to width . . .	1 : 1·75.
Length about	45 mm.

This form differs from the preceding, chiefly in the greater relative length of the whorls, and consequent difference in the shape of the aperture. The *section* is pretty much on the same plan; but, as the folds were somewhat smaller, there was more interior space, the anterior fold on the columella being markedly less than in *Ptyg. brevivoluta*.

A single specimen from the Lincolnshire Limestone of Weldon, to which I give the temporary name of "*sub-brevivoluta*."

N.B.—In spiral angle and internal structure *Ptyg. brevivoluta* and the Weldon form rather remind us of the figure of *N. subtruntrutana*, D'Orb. (T. J. 2, p. 94, pl. ccliv, figs. 1 and 2), a species described by D'Archiac from the Bathonian of Eparcy. But that species has a thoroughly conical figure and no sutural prominences. Moreover, the spiral ornamentation is very marked.

Family—TURRITELLIDÆ.

"*Shell imperforate, turrited, many-whorled, conical, elongate; aperture small, rounded, oval, or sub-quadrangular, entire or slightly notched at the base; lip simple, arched, or sinuous; operculum corneous . . . .*"—FISCHER.

It is quite possible that *Cerithinella* and even *Pseudalaria*, which I have placed provisionally under the CERITHIIDÆ, should be regarded as belonging to this family.

Genus—TURRITELLA, Lamarck, 1801.

"*Shell elongated, many-whorled, spirally striated; aperture rounded, margin thin, operculum horny . . . .*"—S. P. WOODWARD.

As restricted by Fischer the family of the Turritellidæ is mainly composed of this one genus, which, he says, commences in the Lias, and embraces more than 400 species of fossils. S. P. Woodward, on the other hand, traced the genus no further back than the Neocomian. There can be little doubt, however, that fossils with a very strong resemblance to existing *Turritellæ* are far from uncommon in the Lias, and several species, yielding remarkably handsome shells, occur in the Inferior Oolite of this country.

It is just possible that some of these species might be referred to Semper's genus, *Mathilda*, but only, perhaps, in a subgeneric sense. Laube described and figured a small shell, 9 mm. in length, from the Brown Jura of Balin, under the name of *Mathilda euglypha* (vide postea, p. 235). He also refers to *Turritella eucycla*, Héb. and Desl. ('Foss. Mont.-Bellay,' p. 47, pl. ii, fig. 11) as belonging to the genus *Mathilda*. The authors of this last-quoted work observe that their *Turritella eucycla* greatly resembles "*Cerithium*" *zic-zac*, Desl., from the Lias, and "*Cerithium*" *amœnum*, Desl., from the "Oölite ferrugineuse," although specifically distinct. All these fossils are Turritellids, and they appear to be related to each other so as to constitute a group.

Attention has been drawn lately by Mons. Cossmann (Ét. Bath., p. 221) to the probability of many of these Jurassic Turritellas belonging to the genus *Mathilda*, as suggested by Laube. He has, in fact, discovered the peculiar sinistral apex and "embryonic button," held to be one of the characteristics of Semper's genus, in the species named by him *Mathilda Janeti*. He describes eight species in all from the Bathonian of France under the genus *Mathilda*.

There can be no doubt whatever that the specimen from the Upper Lias of Heyford (Pl. XVII, fig. *x*), procured by Mr. Crick of Northampton, is closely related to *M. euglypha*, Laube, though sufficiently different perhaps to be regarded as specifically distinct. The "embryonic button" and general features of the shell speak strongly in favour of its being placed under the genus *Mathilda*. Possibly most of the Turritellids figured on Pl. XVII, with the exception, perhaps, of *T. Dorsetensis*, might be allowed to follow suit. As a matter of fact I propose to describe these species under the genus *Turritella*, placing the word *Mathilda* in brackets. The genus *Mathilda* was made to receive certain Tertiary fossils; its family relationships are somewhat mixed, since it possesses the shell of a *Turritella* with the sinistral apex of the Pyramidellidæ.

As might be expected these long and slender shells are usually in a fragmentary condition, and for the most part the apertures are not preserved. The spiral ornamentation and peculiar axial cross-hatching, in addition to the great width of the sutural sulcus, may be regarded as characteristic of the section associated with the genus *Mathilda*. These fossils occur chiefly, if not entirely, in the Lower Division of the Inferior Oolite, and principally, as far as my experience goes, in Dorsetshire and Yorkshire.

165. Turritella Dorsetensis, sp. nov. Plate XVII, figs. 1 *a*, 1 *b*, 1 *c*.

Description:

Spiral angle	10°.
Height of whorl to width . . .	1 : 1·15.
Approximate length	110 mm.

Shell conical-elongate, inversely turrited. Whorls about 30; these increase with great regularity, are slightly excavated, and provided with a prominent carina a short distance above the suture. Actual apex unknown. In the apical whorls the carina is relatively more prominent, and the position of the carina in some cases more median. The position of the carina varies considerably in different specimens, but is in all cases anterior, and in some mature specimens rather near the base of each whorl. The carinæ are richly granulated by the cross-hatching, or axial ornamentation, which is very fine and close in this species. In the more apical whorls there are about four fine spirals above the carina and about two below, but this number increases with age, so that in some specimens the adult whorls have as many as seven spirals above and four below the keel, the latter being much crowded together. This represents the usual form (figs. 1 *a*, 1 *c*), but there is a variety (fig. 1 *b*) where the keel is more centrally situated, and where the

number of spirals above the keel is only five. Other specimens present trifling differences.

The base is nearly flat and spirally striated; columella short, aperture subquadrate and restricted. (N.B.—The columellar lip is too much rounded in the figure.)

Relations and Distribution.—This species stands out very prominently from the other Turritellids of the Inferior Oolite, being distinguished by the conical form of the whorls and by the prominence of the single carina near the base of each whorl. *T. Dorsetensis* differs from the *T. Schlumbergeri*, Eug. Desl., in its richer ornamentation, and in having, in the adult shells, a greater number of spirals, but, above all, in the more median position of the keel. In the variety from the *Murchisonæ*-zone of Bradford Abbas (fig. 1 *b*) this difference in the position of the keel is at its maximum.

T. Dorsetensis occurs rarely in the Irony-nodule Bed of Burton Bradstock, and in the Lower Division of the Inferior Oolite of Bradford Abbas, where it is also rare. A small fragment has been found in the freestones of the Inferior Oolite near Cheltenham (Brodie Collection).

166. Turritella cf. Schlumbergeri, *Eugène Deslongchamps*, 1863—66. Not figured.

1863—69. Turritella Schlumbergeri, *Eugène Deslongchamps*. Notes Paléontologiques, p. 93, pl. viii, figs. 8 *a*, 8 *b*, 8 *c*.

The late Prof. Eugène Deslongchamps founded his species upon four specimens belonging to the Faculty of Sciences at Caen procured by Mons. Schlumberger from the Inferior Oolite of the Meurthe. None are quoted from the "Oölite ferrugineuse" of Normandy.

This species has considerable affinity with *T. Dorsetensis*, but the keel is represented as being less prominent, and, moreover, is placed much nearer the base of the whorls, so that only one spiral instead of four occupies the space between the keel and the suture.

One specimen, answering fairly well to the figures and description in the 'Notes paléontologiques,' is in my possession from the Inferior Oolite of Dorsetshire. It is interesting to make this identification, since the fossils from the so-called *Sowerbyi*-bed of the Meurthe seem to possess considerable affinity with those from the *concavus*-bed of Bradford Abbas. Possibly *T. Dorsetensis* might be regarded as a marked local variety of *T. Schlumbergeri*.

Turritella opalina group.

The following species or sub-species of *Turritella*, occurring in the Inferior Oolite of England, are placed in this category. *Turritella abbas*, sp. n., *T. opalina*, Quenstedt, and var. *canina*, Hudleston, *T. strangulata*, sp. n. These forms may belong to the genus *Mathilda*.

167. Turritella (*Mathilda*) abbas, sp. nov. Plate XVII, figs. 2 *a*, 2 *b*, 2 *c*.—cf. *Turritella septemcincta*, Münst., Goldf., Pl. 196, fig. 12.

Description:

Spiral angle	9°—11°.
Height of whorl to width	1 : 1·1.
Approximate length	70 mm.

Shell elongate, turrited, much indented by the sutural sulcus. Number of whorls from 16—20. Indications of a sinistral apex have been observed on one specimen. Between the subapical and anterior whorls there is but little difference except as to size; in shape the whorls are narrow and subtumid, the chief protuberance being postero-mesial, with a tendency to be pinched in at either extremity. The spirals are seven in number; usually there is a slight space between the first spiral and the suture, the second spiral is about equidistant, both are situated in a depressed area and are small. Between the second and third spirals there is a sharp rise of the whorl, and upon the most salient portion occurs the third spiral, which is the largest of all and constitutes the principal prominence; it might almost be described as a carina; the fourth and fifth spirals are nearly as large, the sixth spiral is sometimes small, the seventh spiral occupies the base of the whorl close to the suture. These ornaments are subject to a certain amount of variation in individual specimens; both the spiral and the interspiral spaces are cross-hatched, but in this species the spirals are not deeply cut or granulated. Specimens such as fig. 2 *c* exhibit some difference as to the size of the spirals; for instance, the sixth spiral is large and the whorls rather more tumid, showing, in fact, a passage towards the form recognised as *T. opalina*.

The base is very flat and has from two to three spiral ridges; aperture ovate with a slight tendency to be subquadrate anteriorly.

Relations and Distribution.—Turritella abbas clearly differs from *T. opalina* in the narrow and elongate character of the whorls. As regards *T. septem-cincta*,

Münster, that species was founded on a fragment, some 12 mm. in length, said to come from the Lias. The enlargement by Goldfuss shows a whorl not dissimilar to that of *T. abbas;* but, as we are left in doubt on many points, it is safer to make a new species in this case, and I am the more inclined to do so because *T. abbas* is decidedly the characteristic and most abundant *Turritella* in the Inferior Oolite of Dorsetshire.

T. abbas occurs chiefly in the *concavus*-bed at Bradford Abbas, where fragments are not uncommon; it also occurs in the corresponding zone near Beaminster, and has been noted rarely in the Pea-grit of Crickley.

168. Turritella (*Mathilda*) opalina, *Quenstedt*, 1858. Pl. XVII, fig. 3 *a*.

1858. Turritella opalina, *Quenstedt*. Der Jura, p. 326, pl. xliv, fig. 13.

Bibliography, &c.—This is most probably the *Turritella elongata* of Zieten (= *Cerithium elongatum*, d'Orb, Prod. 1, p. 250). The specific name *elongata* had been already appropriated by Sowerby for a *Turritella* of Tertiary age, cf. Hudleston, 'Geol. Mag.,' dec. 3, vol. i (1884), p. 200. Quenstedt's name may be accepted as a generalised term for elongate *Turritellæ* of Jurassic age possessed of about six or seven spirals, but the following description relates to a specialised form which, it is believed, more distinctly resembles Quenstedt's species.

Description:

Spiral angle	14°—15°.
Height of whorl to width	1 : 1·75.
Approximate length	45 mm.

Shell conical-elongate, spiral angle very regular, sutural sulcus wide. Whorls about fifteen, short and tumid, the chief prominence nearly mesial. Sinistral apex probable. Usually there are six spirals, the fourth and fifth being the most prominent; between these two is a sulcus of considerable depth, the impression of which is left on the internal mould. The cross-hatching or axial ornamentation, as in the *opalina*-group generally, is distinct, equally spaced, and but slightly oblique; the spirals are slightly granulated.

Base very flat and slightly excavated; aperture subcircular with a tendency to be subquadrate anteriorly, columellar lip short and straight.

Relations and Distribution.—Quenstedt does not give a detailed description of *T. opalina*, but the fossils now under description correspond well in proportions, and to a certain extent in ornamentation with that author's figure; our examples are rather shorter. It is clearly distinguished from *T. abbas* by its more conical

figure, wider spiral angle, and by the shorter and more tumid whorls. The details of ornamentation also differ considerably.

But just as there are specimens, such as fig. 2 *c*, which seem to connect *T. abbas* with *T. opalina*, so also there are specimens which serve to bridge over the gap between *T. opalina* and *T. quadrivittata*. On the other hand fig. 3 *b* represents a richly ornamented and unusually well-preserved specimen of *T. opalina*, where the sulcus between the two principal carinæ is occupied by a secondary spiral, thus adding to the number.

A single specimen of *T. opalina* has been found in the *opalinus*-bed of Burton Bradstock. A few in a better state of preservation have been obtained from the *concavus*-bed, Bradford Abbas. It may also occur in the Dogger at Blue Wyke and in the Millepore-bed.

169. Turritella (*Mathilda*) opalina, var. canina, *Hudleston*, 1884. Plate XVII, fig. 4.

1884. Turritella opalina, *Quenstedt*, var. canina, *Hudl.* Geol. Mag., dec. 3, vol. i, p. 200, pl. vii, fig. 9.

Description:

Spiral angle	20°—23°.
Height of whorl to width . . .	1 : 2.
Approximate length	40 mm.

This variety possesses the conical shape of *T. opalina*, but under a wider spiral angle, and the relative width of the whorls is greater. The whorls are very short and globose, and separated by a well-marked sutural sulcus. The apex is unknown; the subapical whorls are globose and have about seven spirals; the more mature whorls have about eight. Of these, three nearly equal strap-like bands are distinguished, occupying the area a little below the centre, the uppermost of the three being slightly the strongest and representing the most salient portion of the whorl. Owing to the crowding of the spirals (and partly also to the peculiarity of the matrix) the cross-hatching is not conspicuous. Aperture similar to that of *T. opalina*, but slightly more orbicular.

Relations and Distribution.—The relations of this variety to other members of the *opalina*-group have been already indicated. A very few specimens have been found in the Dogger at Blue Wyke. Specimens approaching this variety, such as fig. 3 *b*, occur in the *concavus*-bed, Bradford Abbas.

170. Turritella (*Mathilda*) strangulata, sp. nov. Plate XVII, fig. 5.

Description:

Spiral angle	12°.
Height of whorl to width . . .	1 : 1.
Approximate length	65 mm.

Shell elongate, strongly turrited, deeply sulcated, sutural angle very oblique. The whorls (about fifteen) are long and irregularly bulging, the principal prominence being posterior, where also is situated the principal spiral or carina. The spirals are six and sometimes seven in number, the third being the most prominent. Cross-hatching is conspicuous throughout the shell, the lines being nearly parallel to the axis, and fairly close. Other indications wanting.

Relations and Distribution.—This species is distinguished from *Turritella abbas* by the width and depth of the sutural sulci, which, in conjunction with the excessive postero-mesial bulge of the whorls, give a curious strangulated appearance to the spire; the ornamentation also is coarser than in *T. abbas*. As regards the outline of the spire, *T. strangulata* has considerable resemblance to *T. Hartmanniana*, Münst. (Goldf. iii, p. 98, pl. cxcvi, fig. 8, a fossil of the Lias). But, to judge from the enlargement of Münster's species, the ornamentation differs considerably.

Note on the *opalina*-group. From *Turritella eucycla*, Héb. and Desl., and from *T. Clapensis*, Terquem and Jourdy, the members of this group are separated by the greater number of spirals in the whorls. Both the last-named fossils are more nearly related to *T. quadrivittata*, Phil.

171. Turritella (*Mathilda*) quadrivittata, *Phillips*, 1829. Plate XVII, fig. 6.

1829 and 1835. Turritella quadrivittata, *Phillips*. Geol. Yorks., pt. 1, p. 129, pl. xi, fig. 23.
1850. Cerithium quadrivittatum, *d'Orbigny*. Prod. i, p. 271.
1884. Turritella quadrivittata, *Phillips*. Hudleston, Geol. Mag., dec. 3, vol. i, p. 202, pl. vii, figs. 11—13.

Bibliography, &c.—Without multiplying references it may be sufficient to state that authors have differed greatly as to whether Phillips' species should be regarded as a *Cerithium* or a *Turritella*. Morris, in his 'Catalogue,' enters it under

both genera—a very unusual proceeding. It clearly belongs to the *Mathilda*-like *Turritellæ*. It is possible that two species, or at any rate two varieties, are included under *T. quadrivittata;* one a wide, the other a narrow form. The wider form, which is Phillips' type, is represented in pl. vii, figs. 11, 12 of the above quoted volume of the 'Geological Magazine.' The narrower form is represented in pl. vii, fig. 13, and also in Pl. XVII, fig. 6, of the present work.

Description.—Accepting, at least provisionally, the view that both wide and narrow forms belong to one species, the spiral angle will range from 18°—28°. The height of whorl to width is about as 1 : $1\frac{3}{4}$, and the average length may be about 20 mm.

The spire consists of from ten to twelve whorls; apex unknown. The whorls are sub-globose, sutural sulcus wide with sometimes a faintly-marked rim in the centre. Each whorl is ornamented by four granular spirals, the third being the strongest and most granulated. The cross-hatching is close and sinuous, decussating with the spirals so as to form nodes. Base nearly flat, and spirally striated: aperture suborbicular.

Relations and Distribution.—The differences which separate this species from the *opalina*-group have been already indicated. *Turritella tricincta,* Münst. (Goldf. pl. cxcvi, fig. 11), a fossil of the Lias, may possibly be merely a variety, *T. eucycla* and *T. Clapensis* may be regarded as elongated and eucycloid varieties of the *quadrivittata*-group, the former especially coming near to the narrow section of *T. quadrivittata.*

Rare in the Dogger and Millipore-bed; a single specimen from the Lincolnshire Limestone of Weldon. A variety, which occurs in the shell-bed at Pitcombe, and also in the *concavus*-bed at Bradford Abbas, develops an additional spiral posteriorly; it belongs to the slender section, and is closely related to *T. eucycla,* Héb. and Desl.

172. Turritella (? *Mathilda*) cf. binaria, *Hébert and Deslongchamps,* 1860. Plate XVII, fig. 7.

1860. Turritella binaria, *Héb.* and *Desl.* Foss. Mont.-Bellay, p. 47, pl. vi, fig. 7; pl. viii, fig. 10.

A fragment consisting of four whorls from the Lower Division of the Inferior Oolite near Beaminster presents so many points of resemblance to the Callovian species from Montreuil-Bellay that I feel justified in making this reference, pending the discovery in our Inferior Oolite of more complete specimens.

Our fragment shows a spiral angle of about 14°. The whorls, which are

separated by a wide sutural sulcus, are angular and strongly bicarinate, the upper carina being the most prominent. Besides the two central carinæ a fine spiral line is noticeable towards the top and bottom of each whorl, and in the last whorl the lower of these has considerable prominence, forming the edge of the base. The cross-hatchings in this specimen are wide apart and considerably oblique to the axis.

The Beaminster specimen most resembles pl. viii, fig. 10, of the "Fossils of Montreuil-Bellay," but there are elements of difference. It has also some affinity with "*Cerithium*" *amœnum*, Desl. ('Mém. Soc. Linn. Norm.,' vol. vii, p. 201, pl. xi, figs. 16, 17, 18). It is most probably one of the *Mathilda*-like *Turritellæ*.[1]

Family—PSEUDOMELANIIDÆ.

"*Shell elongate, turrited, many-whorled, resembling that of the Melaniidæ; aperture oval, usually entire, seldom notched or channeled at the base; columella simple or folded anteriorly, lip thin, arcuate, slightly sinuous.*"—Fischer.[2]

I have already indicated (pp. 8 and 144) the reasons for no longer making use of the old term "*Chemnitzia*" for any of the *Melania*-like shells of the Jurassic rocks. As regards the genus, *Pseudomelania* (including Gemmellaro's sections—*Pseudomelania* as restricted, and *Rhabdoconcha*), there is no difficulty. In this we perceive a very natural group of which the Corallian species, *Pseudomelania Heddingtonensis*, may be taken as the type. The genus is also well represented in the Inferior Oolite.

Neither is there much difficulty with respect to such a shell as *Bourguetia* (*Phasianella*) *striata*. This we can readily refer with Fischer to the Pseudomelaniidæ. Then comes the question what are we to do with the numerous,

[1] Attention should here be drawn to some curious fossils lately discovered by Mr. Crick in the Upper Lias of Heyford (see Pl. xvii, fig. *x*). These resemble *Mathilda euglypha*, Laube. I would scarcely aver that the two forms are specifically identical. *M. euglypha* has a much larger habit, being at least 10 mm. in height, whilst the Heyford specimens do not average more than 3 mm. Moreover, if we can trust to the enlargement in Laube's figure, there is much more decussation of ornament in *M. euglypha*. The spiral angle is about the same, viz. 24°. Our fossil exhibits the embryonic button in an excellent state of preservation.

The specimens on which the drawings and description of this species of *Mathilda* are based have been kindly lent to me by Mr. Crick. I suggest that the species be known as Mathilda Crickii.

[2] "It would be curious to investigate from the point of view of descent whether the Pseudomelaniidæ had not furnished two parallel branches, the one marine becoming extinct in the Tertiaries, the other fluviatile and related to the existing Melaniidæ" ('Manual,' p. 697).

smooth, subturbinate shells, often rather small, which have been hitherto regarded as Phasianellas? Their intimate connection with *Bourguetia striata* has been admitted when both were classed under *Phasianella*. In fact, Fischer (Man. p. 812) says, "La plupart des prétendus *Phasianella* des terrains Jurassiques sont des *Bourguetia*." We might then rank these as a second section of *Bourguetia*, or we might make use of Gemmellaro's subgenus *Oonia*, to help us out of our difficulty. Judging from Gemmellaro's figures such shells as *Oonia turgidula*, Gemm., are scarcely to be differentiated from some of our Inferior Oolite "Phasianellas." Without in the least degree believing that this group has any connection with the Turbinidæ as the name, *Phasianella*, would imply, I have concluded to continue the use of "*Phasianella*," simply as a term borrowed from existing conchology, whilst classifying with a query under Pseudomelaniidæ.

This family is represented in the Tertiaries by *Bayania*, Mun. Chalmas, in the Cretaceous and Jurassic by *Pseudomelania*, and in the Palæozoic by *Loxonema* and *Macrochilus*. The latter seems to have had a slight fold on the columella.

Genus—Pseudomelania, Pietet and Campiche, 1862.

Shell turrited, elongated (spire pointed), not umbilicated, thick; ornaments usually confined to lines of growth; aperture oval, entire, regularly rounded in front, and terminating posteally in an angle; columella thick, and sharing in the general curvature of the mouth, always without folds.

Abridged from "Les fossiles du Terrain Crétacé des environs de Ste. Croix."

The authors further distinguished this genus from "*Chemnitzia*" by the mouth being regularly rounded in front, and by the absence of transverse (*i. e.* axial) ribs; from *Eulima* by the unpolished surface; from the Pyramidellidæ by the absence of columellar teeth; from *Niso* by the want of umbilicus. According to the authors the genus appeared in the Trias, attained its maximum in the Jurassic, and diminished in the Cretaceous, beyond which period it did not pass.

Some slight modifications of the above diagnosis may be required. Thus the earlier Pseudomelanias of our Oolitic rocks develop a tendency to nodose ornament, which they may have inherited from ancestors in the Lias, such as *Melania nodosa*, Desl. found in the Upper Lias of Fontaine Étoupe-Four. In one case also, as we shall perceive, there is a slight tendency to an anterior notch in the aperture. It may be doubted also whether the spire is much pointed in all cases.

There is great variety of form in the *Pseudomelaniæ* of the Inferior Oolite; yet, within certain limits, the group represented by *Pseudomelania procera*, Desl.,

which itself runs into *Ps. lineata*, Sow. might almost be regarded as one species. Certainly, it would save much trouble to adopt this view, as is generally done in our museums, where nearly every *Pseudomelania* from the Inferior Oolite is labelled *Chemnitzia lineata*, Sow. In singling out certain forms for specific distinction it is not maintained that these do not run into each other; according to the belief now universally accepted they must needs do so. The *lineata-procera* group may be held to embrace such extreme forms as *Ps. heterocycla* (Pl. XVIII, fig. 4) and *Ps. coarctata* (Pl. XVIII, fig. 9). In all of them the early whorls are smooth, flat, and scarcely project; presently the whorl is slightly constricted, the sutural space widens, and turriting or reversed turriting supervenes.

Accepting the specific distinctions which it seems convenient to adopt, the following species characterise the Lower Division of the Inferior Oolite, viz. *Ps. procera*, Desl. (long variety), *Ps. bicarinata*, Wright, MS., and *Ps. heterocycla*, Eug. Desl.; whilst in the Upper Division we have *Ps. lineata*, Sow., *Ps. procera*, Desl. (short variety), which is nearly the same thing as Sowerby's species, and *Ps. coarctata*, Desl.

173. Pseudomelania procera, *Deslongchamps*, 1842. Plate XVII, fig. 9, Plate XVIII, figs. 1 and 2, Plate XXI, fig. 1.

1842. Melania procera, *Desl.* Mém. Soc. Linn. Norm., vol. viii, p. 222, pl. xii, figs. 5, 6.

1882. Chemnitzia lineata, *Sow.* Hudleston, Geol. Mag., dec. 2, vol. ix, p. 241, pl. vi, figs. 1 and 2.

Bibliography, &c.—As before observed, it has been the fashion to refer most of the Pseudomelanias of the Inferior Oolite to Sowerby's species, and thus the elongate form in the Dogger was so referred by me. Subsequently I have concluded that the original *Melania lineata*[1] represents the form in the iron-shot Oolite of Dundry, which has smooth whorls with little or no turriting and scarcely any constriction.

Description [N.B.—The chief points of distinction between the members of

[1] It is probable that the name *lineata* was given by Sowerby with reference to the wavy lines of growth, which are really characteristic of the genus. Mr. Tawney ('Dundry Gasteropoda,' p. 16) believed the chief characteristic to be the lines of puncta arranged spirally, which, he says, alone perhaps enables one to distinguish it from *Ps. procera*. This structure can only be seen occasionally and under peculiar conditions of preservation, and is not of much value for differentiation, since it may be seen in almost every species of *Pseudomelania* in the Inferior Oolite, but best in those specimens where the outer shell-layer has been partly destroyed.

the *lineata-procera* group are briefly stated; the apical whorls are very similar in all]:

Spiral angle	12°—15°.
Height of whorl to width . .	1 : 1·2.
Length variable, say	70—80 mm.

Shell moderately turrited, extremely smooth and destitute of ornament save lines of growth, but under certain conditions, exhibiting a striato-punctate structure, sutures close, whorls very slightly constricted, and raised towards the posterior border where there is a faint bevilled edge. The body-whorl is sometimes rather rugose from lines of growth.

The very peculiar and highly subulate form (Pl. XXI, fig. 1) is probably an extreme variety of *Ps. procera*. The conditions of mineralization, where the outer shell-layer is entirely gone, serve to disclose the striato-punctate structure in this specimen to a marked degree.

Relations and Distribution.—This is the narrowest and least ornamented of all the Pseudomelanias of the Inferior Oolite. The long form is characteristic of the *Murchisonæ*-zone, and is fairly abundant at Blue Wyke. It occurs also somewhat rarely in the Cotteswolds, and in the "Dew-bed" at Bradford Abbas. Immature specimens are not easy to distinguish, but the whorls are appreciably longer in proportion to their breadth than those of *Ps. lineata*, Sow.

A specimen of *Ps. procera* in the cabinet of Mr. Brodie, from the *opalinus*-zone of Buckholdt Wood, exhibits the tendency to sutural gaping in the later stage which is so characteristic of the species next to be described. The body-whorl exhibits striato-punctate structure spirally arranged.

The variety *minor* (Pl. XVII, fig. 9) is a shortened form which serves to connect with *Ps. lineata*, Sow. This variety probably would also include *Ps. acicula*, Desl. It is rare in the *Parkinsoni*-zone at Burton Bradstock.

The Dogger varieties of *Pseudomelania* are repeated in the Northampton Sand at Duston. The prevailing form is *Ps. procera*, having a tendency towards the species next described.

174. Pseudomelania bicarinata, *Wright, MS.* Plate XVIII, figs. 3 *a*, 3 *b*, 3 *c*.

Description:

Spiral angle	12°—16°.
Height of whorl to width . .	1 : 1·2.
Length of well-grown specimen, say .	100 mm.

This is a variable shell and somewhat dimorphous. The apical whorls are

smooth and flat with close sutures, which presently begin to gape widely, when a sharp bevilled edge or keel appears at each extremity of the whorls, which undergoes a considerable amount of constriction. The lower of these sharp keels is ornamented with a variable amount of tubercles, which are well developed on the body-whorl, where they constitute a handsome carina at the commencement of the sloping base.

Relations and Distribution.—Although so different in appearance to the close-sutured, smooth, and unornamented *Ps. procera*, the connection between the two is by no means difficult to trace, whilst the affinities with the next described species are still closer. Strictly speaking it is probable that the differences are varietal rather than specific.

Pseudomelania bicarinata is abundant in the *concavus*-bed at Bradford Abbas, whence specimens were obtained by Dr. Wright. A similar but rather narrower shell, with gaping sutures and tuberculated carinæ, occurs in the *opalinus*-zone of Burton Bradstock, and possible also in the Dogger. Similar forms occur in the Gryphite grit of Stroud.

175. Pseudomelania heterocycla (*Eugène Deslongchamps*), 1863—69. Plate XVIII, figs. 4 *a*, 4 *b*, 4 *c* (variety).

1863-69. Chemnitzia heterocycla, *Eugène Deslongchamps.* Notes Paléontologiques, p. 91, pl. viii, fig. 7.

Description:

Narrow and long variety from the *concavus*-bed, Bradford Abbas:

Spiral angle	12°.
Height of whorl to width	1 : 1·2.
Length of well-grown specimen	110 mm.

Wide and short variety from Coker:

Spiral angle	18°.
Height of whorl to width	1 : 1·4.
Length	60—70 mm.

The Coker fossil resembles the figure in the "Notes paléontologiques" more than the common form from Bradford Abbas. The following is the author's description: "Shell slender, with a sharp spiral angle (his figure shows an angle of 20°), whorls numerous, the number varying with the age; smooth when young, but showing later on a keel near the suture, which ends in becoming a range of nodosities slightly marked, but more and more pronounced according as the shell advances in age."

Relations and Distribution.—The most peculiar feature of *Ps. heterocycla* is a sort of reversed turriting which arises from the overlap of each whorl by its predecessor in the adult or carinated portion of the shell. It is this character, in conjunction with the slight constriction of the whorl, which serves to distinguish it from *Ps. bicarinata*. But the two forms run into each other very much, especially in the Bradford Abbas beds, so that they might be regarded as one species. In such cases, the older name, *heterocycla*, would seem to have the preference, although possibly there might be no overlap of the whorls.

It is noteworthy that Eugène Deslongchamp's type comes from the so-called *Sowerbyi*-bed of the forest of Haye (Meurthe), and not from the "Oölithe ferugineuse." This shows it to be a fossil of the Lower Division, which is exactly what we find on this side the channel. The Coker-beds are in the *Murchisonæ*-zone. The narrow form is extremely abundant in the *concavus*-bed at Bradford Abbas, and this same form occurs also in the Lower Trigonia grit of Leckhampton.

176. Pseudomelania, species or variety. Plate XVIII, fig. 5.

Description:

Spiral angle	22°.
Height of whorl to width . . .	1 : 1·45.
Length	85 mm.

This form approaches *Ps. bicarinata*, but has the whorls shorter, and the sutures do not gape so much. In the shortness of the whorl and wider spiral angle it more resembles the Coker variety of *Ps. heterocycla*. The nodosities are coarser than in either species.

As a mere distinction this may be known as *Pseudomelania "robusta."* A single specimen from the *opalinus*-zone (*Moorei*-beds), Coaley Peak.

177. Pseudomelania, species or variety. Plate XVIII, fig. 6.

Description:

Spiral angle	18°.
Height of whorl to width . . .	1 : 1·3.
Length	70 mm.

This form differs from *Ps. procera* in the wider spiral angle and somewhat

shorter whorls. Some of the specimens, such as the one figured, are apt to recall certain stages of *Ps. Heddingtonensis.*

For distinction's sake this may be known as *Pseudomelania* "*pinguis*," and regarded as a wide variety of *Ps. procera.*

178. Pseudomelania lineata, *Sowerby*, 1821. Plate XVIII, figs. 7 *a*, 7 *b*.

1821. Melania lineata, *Sowerby*. Min. Conch., pl. ccxviii, fig. 1.
1852. ? Chemnitzia lineata, *d'Orbigny*. Terr. Jur., ii, p. 43, pl. ccxxxix, figs. 4, 5.
1852. — Normaniana, *d'Orbigny*. Vol. cit., p. 40, pl. ccxxxviii, figs. 4, 5, 6.

Bibliography, &c.—There has been a twofold difficulty in dealing with *Melania lineata.* First, in ascertaining what form Sowerby really intended; and second, in discovering his reasons for the name adopted. In the footnote to *Ps. procera* this subject has been discussed. I would only further remark that Sowerby says the striæ are very fine, regular, and elegantly bent to form the lip. This shows clearly that it was to the lines of growth and not to the spiral punctate structure he was alluding.

Description:

Spiral angle	18°—20°.
Height of whorl to width . . .	1 : 1·45.
Length	50—60 mm.

Shell conical, subelongate. Whorls smooth and tumid throughout, the contraction in the upper part of the whorl being so slight as to be scarcely visible; no keel or posterior margin. The number of whorls is from nine to twelve; in many specimens both linear and spiral structure is well seen.

Relations and Distribution.—*Ps. lineata* may generally be distingished from nearly all varieties of *Ps. procera* and its more immediate allies by the small trace of turriting, and by the shortness and almost uniform tumidity of the whorls. It may be said, however, to inosculate with *Ps. procera*, through the var. *minor*, of which *Ps. Normanniana*, d'Orb., may be regarded as a still smaller variety.

The type is from the ironshot Oolite of Dundry, which is believed to be in the *Humphriesianus*-zone, where the form is not uncommon. This species also occurs in the *Humphriesianus*-zone at Oborne, and a smaller variety almost identical with *Ps. Normanniana* is rather abundant in the *Parkinsoni*-zone of Burton Bradstock. Colour-bands and blotches are seen in some of the specimens, but this feature is less common than in Normandy.

179. Pseudomelaria coarctata, *Deslongchamps*, 1842. Plate XVIII, figs. 9 *a*, 9 *b*, 9 *c*, and varieties Plate XIX, figs. 1 *a*, 1 *b*.

1842. Melania coarctata, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 226, pl. xii, figs. 11 and 12.
1842. — turris, *Deslongchamps*. Vol. cit., p. 224, pl. xii, fig. 8.
1852. Chemnitzia coarctata, *d'Orbigny*. Terr. Jur., ii, p. 45, pl. ccxl, figs. 1, 2, 3.

Bibliography, &c.—Irrespective of their gorgeous colouring Deslongchamps' figures of this fine species seem to give a better idea of its form than those of d'Orbigny, though it is generally admitted that there is no necessity for maintaining a distinction between *Melania coarctata* and *Melania turris*. In Dorsetshire there is no difficulty in dealing with the species, but further north the specimens are found in worse condition, and the evidences are less clear.

Description:

Spiral angle	18°—20°.
Height of whorl to width . . .	1 : 1·45.
Length	70—100 mm.

Shell strongly turrited in the adult whorls, but having the subapical whorls without any salience. The young form can scarcely be distinguished from *Ps. lineata;* there is a difference in the colour-bands of individual specimens, but no evidence that this is a constant feature. But specimens such as fig. 9 *c* already begin to show a sudden increase of the body-whorls. After this stage is reached the sudden increase of the whorls is maintained throughout, but differs considerably in degree. The posterior portion of each whorl is provided with a bevilled edge terminating in a carina, below which there is a constriction of the whorls; the anterior portion of the whorl is without any raised edge. Flexuous colour-bands, more or less parallel to the axis, are seen in some specimens, and appear to be more characteristic of *Ps. coarctata* than of any other species. Specimens from the *Cadomensis*-bed, Oborne, show this feature well, as also the fine cross-hatching produced by spiral lineation decussating with the fine lines of growth.

Varieties.—Pl. XIX, fig. 1 *a*, represents a specimen from the *Humphriesianus*-zone at Oborne, where a slight rise is observable in the anterior portion of the whorl, whilst the posterior keel is less prominent, and the sutural sulcus better defined. This is a variety of *Ps. coarctata*, slightly in the direction of *Ps. Lonsdalei*, Morris and Lycett.

Pl. XIX, fig. 1 *b*, represents a specimen from the *clypeus*-grit of Nailsworth Hill in which there is a still further change in the direction of *Ps. Lonsdalei*. But this form differs from all others related to *Ps. coarctata* in the relative length of the whorls, and also apparently in the greater width of the flexuous lines. Too much importance should not be attached to the latter feature in a corroded specimen.

Distribution.—The typical form is nowhere abundant in England, being almost exclusively confined to the *Humphriesianus*-zone. The best and most numerous specimens are from the *Cadomensis*-bed at Oborne.

180. Pseudomelania Lonsdalei, *Morris* and *Lycett*, 1851. Plate XIX, fig. 2.

1851.	Chemnitzia Lonsdalei, *Morris and Lycett*.	Great Ool. Moll., p. 49, pl. vii, fig. 13.
1851?	— Scarburgensis, *Morris and Lycett*.	Op. cit., p. 115, pl. xv, fig. 8.
1882.	— lineata-procera, var. Scarburgensis, *Hudleston*.	Geol. Mag., dec. 2, vol. ix, p. 243, pl. vi, fig. 4.

The essential difference between *Ps. Lonsdalei* and *Ps. coarctata* consists in the softening of the posterior bevilled edge, and the development of a well-defined median sulcus in the whorls, which has the effect of dividing the whorls into a posterior and anterior area, the latter being slightly the larger. These conditions are perfectly fulfilled in the specimen (Pl. XIX, fig. 2) from the Scarborough Limestone of Pickering Cliff in Cloughton Wyke. It is precisely like specimens from the Great Oolite of Minchinhampton. (N.B. The median sulcus is not shown sufficiently well in the figure.) The following are the dimensions: Spiral angle, 16°; height of whorl to width, 1 : 1·4; length, 85 mm.

As *Chemnitzia Scarburgensis* is founded on a cast from the same horizon and locality, the specimen is very likely to have been a cast of this species. A fine specimen from the same place was figured and described by me as *Chemnitzia lineata-procera*, var. *Scarburgensis*. This was certainly "lumping." The figure is now reproduced (Pl. XIX, fig. 3). It differs from *Ps. Lonsdalei*, found in the same place, and might pass for a very narrow variety of *Ps. coarctata*.

181. Pseudomelania simplex, *Morris* and *Lycett*, 1851. Plate XIX, fig. 4.

1851. Chemnitzia simplex, *Morris and Lycett.* Great Ool. Moll., p. 49, pl. vii, fig. 15.

Bibliography, &c.—The authors observe "that the fine example figured is from the hard weatherstone of Bisley Common," *i. e.* presumably from the Great Oolite. Yet in the Jermyn Street Museum, where Morris and Lycett's types are kept, there is no specimen from the Great Oolite, although there is one large specimen placed with the Inferior Oolite Collection. At present, therefore, I am without any direct evidence that *Ps. simplex* occurs in the Great Oolite.

Description.—Since nearly all the specimens seen by me have suffered from compression, no dimensions are given. Large specimens attain a length of nearly 200 mm. The shell is turrited in the anterior whorls; the whorls are smooth, and, except those near the apex, are convex, almost globose, with deeply impressed sutures; aperture oval and oblique, with a considerable columellar callus.

Relations and Distribution.—The considerable convexity of the anterior whorls seems to separate this species from all varieties of the *lineata-procera* group. The aperture also is more oval, showing less of the posterior angle. It is rarely found except as a megalomorph, and is by no means uncommon in the Oolite Marl at Notgrove Station. The exact locality of the specimen figured is unknown, but it is possibly from the Upper Pisolite of the Nailsworth district.

A fragment of a *Pseudomelania* from the "Oolite Marl," Nailsworth, is figured (Pl. XIX, fig. 16). Spiral angle, 25°; height of body-whorl to entire shell, 45 : 100; length, 16 mm. The whorls are elongate, being nearly as wide as high, smooth, convex, clearly separated by a suture, which has no canaliculation or ledge. Body-whorl slightly ventricose, aperture ovate-elongate. This might possibly represent an immature stage of *Ps. simplex*, but is more likely to belong to the "Eulimoid" group of *Pseudomelania*.

182. Pseudomelania lævigata, *Morris* and *Lycett*, 1851. Plate XXI, fig. 6.

1851. Eulima lævigata, *Morris and Lycett.* Great Ool. Moll., p. 114, pl. xv, fig. 4.

1882. — — — Hudleston, Geol. Mag., dec. 2, vol. ix, p. 245, pl. vi, figs. 7 and ? 8.

cf. also 1863. Eulima ? lævigata, *Lyc.* Suppl., p. 13, pl. xxxi, fig. 3.

Bibliography, &c.—Very little of a satisfactory nature can be made out with regard to these quondam "Eulimas" of the Yorkshire Beds. It seems reasonable to regard the Jurassic "*Eulimæ*" as constituting a group of small *Pseudomelaniæ*. The group is more characteristic of the Great Oolite.

When we come to deal with the so-called "*Eulima*" *lævigata* of the Scarborough Limestone, the difficulty is further increased by the divergence between the authors' description and their figure. According to the text the shell is very subulate, the length of the whorls being nearly equal to their transverse diameter. But the figure shows a shell with very short whorls, whose breadth is nearly twice their height. On the whole the figure is more reliable than the text, and more in accordance with the few specimens available. The following description is based upon two specimens from the Scarborough Limestone, one of which is said to be the type.

Description :

Spiral angle	22°.
Height of whorl to width (mean) . . .	1 : 1·8.
Length	14—15 mm.

Shell conical-elongate, scarcely turrited. Whorls 10—12, narrow, smooth, yet showing fine spiral and axial lines where well-preserved, convex. Sutures distinct, but without canaliculation.

Body-whorl rather short, base rounded and smooth. Aperture subovate and slightly expanded anteriorly.

Relations and Distribution.—Since the "subulate" character of this species cannot be maintained, it is not very easy to say in what respect it differs from "*Eulima*" *communis*, Morris and Lycett. Rare in the Scarborough Limestone. A single specimen from the Dogger presents somewhat similar features.

183. Pseudomelania Astonensis, sp. nov. Plate XVIII, figs. 8 *a*, 8 *b*.

Description :

Spiral angle	18°.
Height of whorl to width . . .	1 : 1·45.
Length (full)	20—25 mm.

Shell conical-elongate, scarcely turrited, smooth, spiral angle rather obtuse towards the apex. Number of whorls about sixteen, but often less. The whorls are extremely flat, and fit up close to the suture, so that there is no sulcus. The width of a whorl is equal to its height plus the height of the preceding one;

broad lines of growth, and markings suggestive of colour bands are seen on some specimens.

Body-whorl well within the spiral angle, and entirely without keel; base rounded off; aperture ovate-elongate with a slight posterior angle, rather flattened anteriorly and sometimes exhibiting a small notch or spout.

Relations and Distribution.—As this species is not strictly holostomatous it scarcely comes within the diagnosis of *Pseudomelania*, unless we extend that diagnosis a little. The casts and section prove conclusively that it is not a *Nerinæa*. In its small habit of growth and in other respects this species resembles "*Eulima*" *communis*, Morr. and Lyc. said to be the most common univalve of the Great Oolite. The authors make no mention of the anterior notch in "*Eulima*" *communis*; but there are specimens in my collection from the Great Oolite, not otherwise to be distinguished from *E. communis*, which show the anterior notch distinctly. But the whorls, and especially the body-whorl, are more globose in "*Eulima*" *communis* than in our species.

Cf. *Pseudomelania Laubei*, Cossmann ('Ét. Bath.,' p. 176, pl. xv, fig. 47). No mention is made of an anterior notch in Mons. Cossmann's species, but the figure seems to imply that there might be one. It is probable that the quondam "Eulimas" might constitute a section of *Pseudomelania*.

Ps. Astonensis is rather abundant in the *Parkinsoni*-zone of Aston and Notgrove. A similar form, but smaller, has been found in the Lincolnshire Limestone.

184. Pseudomelania Burtonensis, sp. nov. Plate XIX, fig. 5.

Description:

Spiral angle	30°.
Height of whorl to width . . .	1 : 2·5.
Length	7 mm.

Shell short, conical, scarcely turrited. Number of whorls about nine, short, the width equalling the height plus that of the two preceding whorls. The apex is blunt, and the succeeding whorl is globose and smooth; the succeeding three whorls are marked by stout costulæ, slightly oblique to the axis; the remaining whorls of the spire are smooth and full.

Body-whorl smooth and full, but not ventricose; it occupies between one third and one half the height of the shell. Aperture ovate to suborbicular, rather flattened in front, where there is an extremely faint trace of a notch.

Relations and Distribution.—The apical costulæ remind us of a similar feature

in *Ps. Nerei*, d'Orb ('Terr. Jur.,' ii, p. 50, pl. ccxlii, figs. 5, 6, 7), but in other respects our shell has no resemblance to the fossil of Marquise. This form, again, in the shortness of its spire scarcely comes within the diagnosis of *Pseudomelania*. Five specimens from the *Parkinsoni*-zone of Burton Bradstock are in my collection.

Genus—Cloughtonia, Hudleston, 1882.

Shell short, conical, solid. Whorls about five, flat, angular, and disposed in steps. Suture often canaliculated. Body-whorl more or less bicarinated. Surface smooth, or ornamented with rugose lines of growth. Aperture ovate to ovate-oblong, rounded anteriorly, angular behind. Pillar nearly straight, and with but little callus.

This genus was constituted in order to receive a peculiar group of shells, of which *Cloughtonia cincta*, Phil., may be taken as the type. It is difficult to distinguish from certain Naticas, but the real affinities of *Cloughtonia* are with *Pseudomelania*. *Melania abbreviata*, Römer, which occurs in the Corallian of Bradley near Oxford, may probably be referred to this genus. There are also two forms occurring in the Portlandian of Bucks and the Vale of Wardour, described by me provisionally under *Pseudomelania* ('Geol. Mag.,' September, 1881, p. 389), which belong to *Cloughtonia*.

In 1878 Gemmellaro ('Faune Giuresi,' &c., p. 252) described *Microschiza* as a sub-genus of *Chemnitzia*. This appears to differ but little from *Cloughtonia*, which, therefore, would be merely a synonym of *Microschiza*. Provisionally it may be safer to retain *Cloughtonia* for our English fossils.

185. Cloughtonia cincta, *Phillips*, 1829. Plate XIX, figs. 7 *a*, 7 *b*.

1829 and 1835. Phasianella cincta, *Phillips*. Geol. Yorks., pt. 1, p. 123, pl. ix, fig. 29.
1851. Natica (Euspira) ? cincta, *Phil.* Morris and Lycett, Great Ool. Moll., p. 113, pl. xv, fig. 20.[1]
1882. Cloughtonia cincta, *Phil.* Hudleston, Geol. Mag., dec. 2, vol. ix, p. 203, pl. v, fig. 14.

[1] This figure is so extremely unlike the one by Phillips that it can hardly represent the type, as stated by Morris and Lycett. Nevertheless Morris and Lycett's figure is a faithful representation of the specimen in the York Museum. In some respects this reminds me of *Euspira subcoronata*, see *postea*, p. 270.

Bibliography, &c.—The figures by Phillips and by Morris and Lycett, though supposed to represent the same specimen, are very unlike. The specimen from the Leckenby Collection figured in the 'Geological Magazine' is in a more satisfactory condition, and affords a better notion of the species. One of those figured in the present work, though small, has the mouth very well preserved.

Description:

Spiral angle	45°—55°.
Height of body-whorl to entire shell .	60 : 100.
Length	20—30 mm.

Shell stumpy, and in the majority of cases without any trace of umbilical slit; angle of spire regular, apex probably sharp. Number of whorls from five to six, flat, angular, and step-like, with the posterior margins projecting; suture slightly channeled. Body-whorl strongly bicarinated, the keel near the suture being obtuse, the anterior keel sharp and prominent, the space between the keels slightly constricted, aperture oval and well rounded in front.

The available specimens present no trace of ornament. Specimens from the Lincolnshire Limestone have a narrower spiral angle, are less canaliculate, and the anterior keel of the body whorl is usually less sharp.

Relations and Distribution.—*Cloughtonia cincta* seems to stand alone in our Inferior Oolite. It may possibly be represented in France by *Chemnitzia curta*, d'Orb. ('Terr. Jur. ii,' p. 44, pl. ccxxxix, figs. 6, 7).

It occurs in all three zones of the Inferior Oolite on the Yorkshire Coast, but is most abundant in the Scarborough Limestone. It has also been found on the same horizon in the Castle Howard district. A few specimens are found in the Lincolnshire Limestone at Weldon and Ponton, but none have hitherto been discovered either in the Cotteswolds or in Dorsetshire.

Genus—Bourguetia, *Deshayes in Terquem*, 1871.

"*Shell large, conical-turrited; spire long, sharp; whorls convex, ornamented with spiral striæ; last whorl ventricose; aperture entire, oval, angular behind, round and enlarged in front; lip simple, sharp.*"—Fischer.

The 1st section of *Bourguetia* may be said to consist of one variable and wide ranging species, which extends from the Inferior Oolite to the Corallian.

186. Bourguetia striata, *Sowerby*, 1814. Plate XIX, figs. 8, 9.

1814. Melania striata, *Sowerby*. Min. Conch., p. 101, pl. xlvii.
1851. Phasianella striata, *Sowerby*. Morris and Lycett, Great Ool. Moll., p. 118, pl. xv, fig. 19.
1852. — — *d'Orbigny*. Terr. Jur., ii, p. 322, pl. cccxxiv, fig. 15, and pl. cccxxv, fig. 1.
1858. — Sæmanni, *Oppel*. Juraformation, p. 387.
1871. Bourguetia striata, *Sowerby*. Terquem and Jourdy, Bath. Moselle, p. 51, pl. ii, figs. 21, 22, 23.
1884. "Phasianella" striata, *Sowerby*. Hudleston, Geol. Mag., dec. 3, vol. i, p. 49.

Bibliography, &c.—It is not a little significant of the vertical range of this species, that the type figure is compounded of two parts, the upper portion from a specimen found at Lymington [1] in Somersetshire, the lower from the Coral Rag of Goatacre.

MM. Terquem and Jourdy, perceiving the objections to placing Sowerby's species under any of the genera to which it had been referred, adopted Deshayes MS. name. On the whole they were disposed to regard the new genus as being more nearly allied to *Natica* than to *Melania*. Fischer has no difficulty in referring *B. striata* to the Pseudomelaniidæ.

Description.—The spiral angle may be taken at from 35°—40°, but with considerable variation either way. Extreme length nearly 200 mm., the shell being about two and a half times as long as wide. In some specimens the spiral angle is regular (fig. 8), in others convex and giving a pupoid appearance (fig. 9). Shell substance thin. Whorls nine or ten, tumid, with a deeply impressed suture, spirally striated; the striæ rather unequally distributed, the most deeply impressed and the widest apart being anterior.

The body-whorl is somewhat less than half the height of the entire shell, ventricose, with rounded base. The spiral striæ or grooves are continued throughout the base, being much deeper and wider apart anteriorly.

Varieties are numerous. The figures represent two medium-sized specimens from the *Murchisonæ*-zone of North Dorset. These may be said to constitute a good local variety, if not a distinct species; the striæ are numerous and the whorls, especially in the pupoid form, very convex. This I propose to call var.

[1] With reference to this place Mr. H. B. Woodward writes as follows:—"Lymington is one mile east of Ilchester on Lower Lias Clay, with here and there small patches of *river gravel* brought down by the River Yeo. I have seen and mapped some of these gravels, and know they contain much *Oolitic* material. Tributaries even now rise at the base of Corallian rocks; so you have at any rate choice of Inferior Oolite or Corallian for the Lymington specimen."

multistriata. These distinctions differentiate the North Dorset fossils more from the typical forms than any characters ascribed by Oppel to his *Ph. Sæmanni*.

The most typical forms, and those most easily matched by Corallian specimens occur in the well known beds on Cleeve Hill. Yorkshire specimens from White Nab, to judge by the figure of Morris and Lycett, are similar to these, but perhaps with fewer striæ. In all the localities (both Inferior Oolite and Corallian) there seems to be a broad and narrow variety side by side.

Relations and Distribution.—This variable species almost constitutes a genus in itself, but the varieties for the most part repeat themselves on the several horizons.

The var. *multistriata* occurs sparingly in the *Murchisonæ*-zone of Bradford Abbas. The more ordinary forms occur in the Pea-grit of the Cotteswolds. The beds on Cleeve Hill, though higher, still belong to the Lower Division, and not to the *Humphriesianus*-zone. The Scarborough Limestone of White Nab, however, contains the Ammonites of this zone. Small specimens of *Bourguetia striata*, much defaced, occur in the Lincolnshire Limestone at Weldon.

"*Phasianella*" *costata*, Witchell ('Proc. Cottes. Nat. Fld. Club,' 1879—80, p. 127, pl iv, fig. 1), from the *Clypeus*-grit of Rodborough Hill is probably another variety.

Bourguetia, Section 2, the conventional Phasianella.

Shell medium-sized to small, oval, conical-turrited, usually few-whorled, solid. Whorls smooth, usually convex, and for the most part devoid of ornament, save faint traces of lines of growth, suture simple. Body-whorl large and sometimes ventricose. Aperture oval, rounded in front, and scarcely angled posteriorly; outer lip curved and full.

The above diagnosis embraces what seems a natural group. It has been suggested that, out of the numerous forms in the Jurassics which have been referred to *Phasianella*, all may not belong to the same genus. This argument will scarcely apply to the group figured on Pl. XIX. These shells must hang together, whatever be the name or systematic position of the genus to which they are assigned.

It has already been stated that the genus *Oonia*, Gemmellaro, appears to fulfil the required conditions. But, although some of that author's figures greatly resemble our Phasianellas, there are considerations which preclude our accepting the name *Oonia* for the group now under consideration. The diagnosis of *Oonia* is somewhat meagre, but the striæ of growth are stated to be sinuous, and it is regarded as a section or subgenus of *Pseudomelania*. The sinuous growth-

lines so characteristic of *Pseudomelania* are absent in these very smooth shells, which also in other respects differ from *Pseudomelania* rather too much to be regarded merely as a section. Similarly there is great outward resemblance in some of the Jurassic Phasianellas to *Ph. australis*, but the large calcareous operculum of *Phasianella* has never been discovered in connection with any of these Jurassic fossils. Hence we hesitate to class them with the Turbinidæ.

If *Bourguetia striata* is really one of the Pseudomelaniidæ, it would seem to carry the second section along with it. Whilst retaining the name "*Phasianella*" for conventional purposes, we may regard the group as most probably belonging to the Pseudomelaniidæ. In the Inferior Oolite the Phasianellas of this section seldom attain to any size, and are somewhat rare except at certain localities in the Lincolnshire Limestone, where they appear to replace the Naticas. To a considerable extent these Lincolnshire Limestone fossils are micromorphs of those occurring in the Great Oolite, but the forms so referred are not precisely similar, though these names are adopted in preference to our giving others. In the Inferior Oolite of the Cotteswolds "*Phasianella*" would seem to be extremely rare.[1] In Dorsetshire it is sparingly represented by a very few forms, which are smaller than those of the Lincolnshire Limestone.

187. "PHASIANELLA" LATIUSCULA, *Morris and Lycett*, 1851. Plate XIX, figs. 10 *a*, 10 *b*.

1851.	PHASIANELLA LATIUSCULA, *Morris and Lycett*.		Great Ool. Moll., p. 117, pl. xv, fig. 16.
1884.	—	—	Hudleston, Geol. Mag., dec. 3, vol. i, p. 50.

Bibliography, &c.—This species was founded on a cast from the Scarborough Limestone, and the authors admit that their remarks were made with a certain degree of reservation. In 1884, no specimens, except the one in the York Museum, being available, I was unwilling to accept *Ph. latiuscula* as a species. There are, however, a certain number of forms, occurring chiefly in the upper beds of the Lincolnshire Limestone, which seem to tally fairly with Morris and Lycett's figure and also with the specimen labelled *Ph. latiuscula* in the York Museum.

Description :

Spiral angle	50°—55°.
Height of body-whorl to entire shell . .	60 : 100.
Length of well-grown specimens . .	25—28 mm.

[1] Lycett, in the 1st vol. of 'Proc. Cottes. Nat. Club,' p. 79, refers to *Ph. turbiniformis* and *Ph. subangulata*. There is no evidence as to what these are.

Shell subelongate, ovate, turrited. Number of whorls in the larger and more typical form six to seven; the width equals the height plus the height of the two preceding whorls; whorls very convex, smooth and slightly flattened at the shoulders. Body-whorl about three-fifths of the entire length, ventricose, base rounded. Aperture ovate (length to width as $1\frac{1}{2}$: 1 nearly), and almost equally rounded at either extremity.

Varieties.—The small form (fig. 10 *b*) seems to represent this species in the Bradford Abbas beds. It is somewhat wider-angled, and the body-whorl more ventricose, and in most specimens the whorls are rather more flattened at the shoulder than is usual with "*Phasianellæ*." The aperture is perfectly oval and some specimens show a considerable umbilical fissure.

Another micromorph (fig. 14 *b*) occasionally met with in the Dorsetshire Beds, combines so many characters that it seems to be related to more than one named form. It is rather more ventricose in the body-whorl than *Ph. elegans*, but approaches that species.

Relations and Distribution.—*Ph. latiuscula* may be taken to represent a sort of average form of the Jurassic "*Phasianellæ*," characterised by a body-whorl more ventricose than in *Ph. elegans*, less so than in *Ph. tumidula*.

It is fairly abundant in the upper beds of the Lincolnshire Limestone, especially at Weldon, but would seem to be rare in the Scarborough Limestone.

188. "PHASIANELLA" ELEGANS, *Morris and Lycett*, 1851. Plate XIX, figs. 11 *a*, 11 *b*, and fig. 12.

1851. PHASIANELLA ELEGANS, *Morris and Lycett*. Great Ool. Moll., p. 74, pl. xi, fig. 27.

Description of the Lincolnshire Limestone variety:

Spiral angle	40°—44°.
Height of body-whorl to entire shell . .	52 : 100.
Length about	25 mm.

Shell conical, ovate, turrited. Number of whorls from eight to nine in full-grown specimens, often fewer; these are smooth, convex, and moderately short. Body-whorl scarcely longer than the spire, but slightly ventricose; base rounded. Aperture as in the preceding.

Relations and Distribution.—Differs from *Ph. latiuscula* in having a narrower spire, and a body-whorl relatively shorter and less ventricose. Specimens from the Great Oolite are much larger, but their proportions are nearly the same.

Ph. elegans is not quoted by Morris and Lycett ('Quart. Journ. Geol. Soc.,' vol. ix, p. 326) as occurring in the "Upper Shelly Beds" at Ponton, but one sees

the name in collections from the Lincolnshire Limestone generally. The small variety, as above described, is fairly abundant in the Lincolnshire Limestone at Weldon, and there are also forms which seem to connect it with the preceding, such as fig. 11 *a*. This particular specimen happens to display striato-punctate structure, reticulating with lines of growth, reminding us of *Littorina punctura*, Bean.

189. "Phasianella" Pontonis, *Lycett*, 1853. Plate XIX, fig. 13.

1853. Phasianella Pontonis, *Lycett*. Quart. Journ. Geol. Soc., vol. ix, p. 342, pl. xiv, fig. 9.
cf. 1851. — parvula, *Morris and Lycett*. Great Ool. Moll., p. 75, pl. xi, fig. 9.

The following is the author's description: "Shell with the whorls (six) convex; spire elevated, apex acute, the last whorl very large and ventricose, aperture oblique, base narrow." It differs but little from *P. parvula*. The whorls in some specimens, such as the one figured (fig. 13), are rather less convex. Occurs in the Lincolnshire Limestone at Ponton, and perhaps also at Barnack and Weldon, and is probably only a local form.

190. "Phasianella" Leymeriei, *d'Archiac*, 1843, var. Lindonensis. Plate XXI, fig. 5.

1843. Phasianella Leymeriei, *d'Archiac*. Mém. Soc. Geol., France, vol. v, pt. 2, p. 380, pl. xxviii, fig. 12.
1851. — — — Morris and Lycett, Gt. Ool. Moll., p. 74, pl. xi, figs. 31, 32.
1852. — — — d'Orbigny, Terr. Jur. 2, p. 320, pl. cccxxiv, figs. 5—7.

Bibliography, &c.—The small shell of Eparcy (10 mm.) originally described by d'Archiac has relationships in the Inferior Oolite as well as in the Great Oolite of this country. The specimens from Minchinhampton, referred by Morris and Lycett to d'Archiac's species, are very much larger, and as a rule have a slightly higher spire and more tumid whorls than the type.

Description of the variety *Lindonensis*:

Spiral angle	55°.
Height of body-whorl to entire shell . .	65 : 100.
Length of figured specimen . . .	21 mm.

Shell short, conical, umbilical fissure scarcely traceable; apex sharp. Number

of whorls in well-developed specimens from six to seven; whorls short, almost flat, and with very little sutural impression. The body-whorl is sub-tumid, and constitutes about two-thirds of the whole length. Aperture oval, the longer diameter being about twice the shorter diameter. Fine spiral striæ (similar to those on *Bourguetia striata*) may be noted on well-preserved specimens.

Relations and Distribution.—This form differs from the type chiefly in its relatively longer spire and in its larger habit of growth. In the flatness of the whorls and in the extremely conical outline of the shell it more nearly resembles d'Archiac's species than do the Minchinhampton specimens.

Occurs rather abundantly at Lincoln in the so-called "Bastard-bed" at the base of the Lincolnshire Limestone, where that series reposes on the Northampton Sand. The majority of the specimens are smaller than the one figured.

Phasianella Leymeriei, d'Arch., is quoted by Morris, Lincolnshire Oolites ('Quart. Journ. Geol. Soc.,' ix, 326), as occurring in the Upper Shelly Beds at Ponton.

191. "PHASIANELLA" CONOIDEA, sp. nov. Plate XIX, fig. 14 *a*.

Description:

Spiral angle	50°.
Height of body-whorl to entire shell . .	60 : 100.
Length of figured specimen . . .	20 mm.

Shell stumpy, conical, solid. Whorls about six, smooth, sub-convex, and but slightly separated by the suture. The apex is sharp and the whorls increase under a regular angle. The body-whorl is large but not ventricose, and its height is only a little more than half the height of the entire shell. Aperture roundly oval.

Relations and Distribution.—An apology is almost needed when one ventures to make a new species of "*Phasianella*." This form differs from the preceding in the increased relative height of the spire, which is so marked that we could scarcely place it under *Ph. Leymeriei*, even as a variety. The aperture also is much shorter and the body-whorl is more stumpy. It is more regularly conical than *Ph. latiuscula*, towards which it has affinities in the opposite direction.

Rare in the Scarborough Limestone. A similar form in the Dogger has rather a wider spiral angle.

X non E. Witchell: Proc. Cotteswold Club 1886. Vol. 8. pl. 5. f. 6. p. 276

192. "Phasianella" cf. subumbilicata, *D'Archiac*, 1843. Plate XIX, fig. 15.

1843. Natica subumbilicata, *d'Archiac*. Mém. Soc. Géol. France, vol. v, p. 378, pl. xxviii, fig. 11.
1852. Phasianella — *d'Orbigny*. Terr. Jur., ii, p. 321, pl. cccxxiv, figs. 8—10.
1884. — — *d'Archiac*, sp. Cossmann, Ét. Bath., p. 254.

Description of the specimen:

Spiral angle	60°.
Height of body-whorl to entire shell	65 : 100.
Length	14 mm.

Shell short, ovate, slightly turrited. Whorls five or six, smooth, narrow, tumid, and slightly disposed in steps. Body-whorl very large and rounded, but not exceeding the limits of the spiral angle. Aperture subcircular to oval; indications of an umbilical groove.

Relations and Distribution.—This form is first cousin to *Natica subumbilicata*, D'Archiac, from which it differs in its larger habit of growth, in the greater height of the spire, and in its less globose outline. It belongs to a section of "Phasianella" which has a general resemblance to the Jurassic Naticas. A single specimen from the Lincolnshire Limestone, Weldon.

193. "Phasianella," species or variety. Plate XIX, fig. 17.

Description of the specimen:

Spiral angle	55°.
Height of body-whorl to entire shell	70 : 100.
Length	5 mm.

This micromorph, of which only a single specimen is in my possession from the Lincolnshire Limestone of Weldon, presents characters not dissimilar to those of *Ph. Leymeriei*, D'Archiac, and it also has some resemblance to the larger species, *Ph. nuciformis*, Morris and Lycett.

Family—NATICIDÆ.

"*Shell turbinate or ear-shaped; aperture entire, columella thickened or callous; lip thin* . . . ."—Fischer.

There are a considerable number of shells in the Jurassic rocks which may safely be referred to the Naticidæ. Their generic grouping, however, is not quite

so obvious. D'Orbigny had no difficulty in referring them all to the genus *Natica*. Whether there were traces of an umbilicus or not, whether the whorls were square-shouldered or round-shouldered, these differences were not accounted as of generic importance. Seeing, however, that the genus thus constituted would include very divergent forms, he divided it into four groups, of which the fourth group, viz. the *Prælongæ*, is characterised by the length of the shell exceeding the width. To this by far the larger portion of his Jurassic *Naticæ* were assigned.

Genus—Natica, Adanson, 1757; as defined by D'Orbigny, 1852.

"*Shell globular, thick, varying from the depressed to the elongated form. Spire usually short. Mouth oval or semilunar, modified by the winding of the spire . . . Umbilical region very variable, simple or compound, open or closed by callosities.*"

Morris and Lycett, in dealing with the Naticidæ of the Great Oolite, classed the round-shouldered forms for the most part under *Natica*, and the square-shouldered forms under a sub-genus—*Euspira* (Ag.). The following is their diagnosis:

Sub-genus—Euspira, Agassiz, 1837, as defined by Morris and Lycett, 1851.

"*Shell smooth, ovate; spire elevated; of few whorls which are angulated, the angles sometimes taking the form of a carina*[1] . . . . *aperture entire, elliptical, modified by the angle of the whorl; base wide, rounded; pillar-lip smooth and excavated, outer lip thin and smooth.*"

Mons. Cossmann, in his 'Contribution to the Fauna of the Bathonian in France," like d'Orbigny, minimises the difference between the round-shouldered and the square-shouldered Naticidæ, but groups the whole under the genus *Ampullina*, Lamarck. This is divided by Dr. Fischer ('Manual,' p. 766) into sections and sub-genera, one of the latter being *Euspira*, which he thus describes: —"*Whorls swollen or canaliculate at the suture; spire sometimes elevated, umbilical fissure but little indicated or concealed.*"

There can be no doubt that most of the Naticidæ of our Inferior Oolite might be classed under *Euspira;* but then we are met by this difficulty, that some of Lycett's species, such as *Euspira canaliculata*, were classed by that author under *Euspira*, whilst others, such as *Natica Oppelensis*, were classed under *Natica*. And yet no shells can have a better title to be regarded as *Euspira* than *Natica Oppelensis*, *Natica adducta*, *Natica Lorieri*, &c. Moreover, the only species of *Natica* known to me in the Lias of this country, viz., *Natica Pelops*, D'Orb. (*N. buccinoides*, Y. & B., *fide* Tate) must come under this designation. In the

[1] The portion of the diagnosis framed for the admission of "*Euspira*" *coronata* is omitted.

Great Oolite, on the other hand, the round-shouldered forms show some increase, so that the Euspiroid forms have not so full a possession of the field as is the case in the Inferior Oolite; though such species as *Euspira Sharpei* and *Euspira pyramidata* are very pronounced.

The following diagnosis will comprehend all the Naticidæ of the Inferior Oolite with the exception of one rare species. These species are nowhere abundant, save *Natica Bajocensis* locally, and with one notable exception they are of medium size.

Genus—Natica; Section A.—Euspiroid or sub-Euspiroid.

Shell globular, or sub-globular, thick; spire short or elevated, always in steps; whorls more or less flattened posteriorly and mostly canaliculate. Columella thick and moderately encrusted, outer lip thin. Sometimes a narrow umbilical fissure. Aperture oval or semilunar, the longer axis ranging from half to three-quarters the total length of the shell. Spiral lines, rather wide apart, may sometimes be traced.

In this division there are forms (sub-Euspiroid) such as *Natica globata*, *Natica Dundriensis*, *Natica Hulliana*, and even *Natica cincta*, where the slope or modification of the sutural ledge (méplat) approaches the round-shouldered species. Hence the difficulty of drawing the line.

In the Lower Division of the Inferior Oolite and generally rather low down is a group of medium-sized shells, of which *Natica adducta* may be taken as the type. This group comprises *Natica adducta*, with *N. Oppelensis* and *N. globata* as varieties, and *Natica Lorieri*, with *N. proxima* and *N. canina* as varieties.

194. Natica adducta, Phillips, 1829. Type form, Plate XX, fig. 3.

1829 and 1835.	Natica adducta,	*Phil.*		Geol. Yorks., pt. 1, pl. ix, fig. 30.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., p. 112, pl. xv, fig. 17.
1852.	—	—	—	d'Orbigny, Terr. Jur., ii, p. 189, pl. cclxxxix, figs. 4, 5.
1882.	—	—	—	Hudleston, Geol. Mag., dec. 2, vol. ix, p. 199, pl. v, fig. 6.

Bibliography, &c.—The history of this wide-spread if not very common species has been slightly complicated owing to Phillips having given two different figures of *Natica adducta*, viz. pl. ix, fig. 30, and pl. xi, fig. 35. The former

was from the Scarborough Limestone, the latter from the Dogger. Since Morris and Lycett refigure the specimen from the Scarborough Limestone as the type, we may so regard it. This form is not rare in all three zones of the Inferior Oolite in Yorkshire, being most abundant in the Dogger.

Description:

Spiral angle . . .	90°—92°.
Height of body-whorl to entire shell	70 : 100.
Length about . . .	25 mm.

Shell longer than wide (5 : 4), oval, apex sharp. Whorls (6 or 7) smooth, convex, and narrow, the width of the penultimate being nearly twice the height of the spire. Upper part of each whorl flattened and moderately canaliculate. Body-whorl relatively large, angular, scarcely tumid, in some specimens marked by fine curved lines of growth.

Aperture widely oval, and with the columella slightly encrusted; rarely indications of an umbilical fissure.

Relations and Distribution.—The above description may be taken as typical of the whole group to a certain extent; hence it will be sufficient to show in what way the other named forms differ from this one. Since it seldom happens that the angles of the whorls are so well preserved as in the figured specimen, the Euspiroid character of *Natica adducta* is not always recognised, the more so as the ledge is rather narrow.

Besides its occurrence in all three horizons of the Inferior Oolite on the Yorkshire coast, I have typical specimens of *Natica adducta* from the lower part of the Lincolnshire Limestone in Mid-Lincolnshire, and again from the Pea-grit and Oolite Marl of the Cotteswolds. Mr. Witchell quotes it from the Gryphite-grit.

Var. Oppelensis, *Lycett*, 1857. Plate XX, fig. 2.

1857. Natica Oppelensis, *Lycett*. Cotteswold Hills, p. 123, pl. i, fig. 4.

This is a small variety of *N. adducta*, which occurs in the Cotteswold Sands of the Nailsworth district (*Opalinus*-zone). Although quite as much an *Euspira* as any one of the Naticidæ in the Cotteswolds, Lycett described this form as a *Natica*. It has exactly the same angle of whorl as *Natica adducta*, and the same ratio of body-whorl to entire shell, viz. 7 : 10. The spiral angle is a little over 90°. The encircling lines, on which Lycett relied for specific characters, are seen on some specimens not on others. These, it is believed, are mainly due to conditions of preservation, where the inner shell layers are exposed. It is

probable that most of the Euspiroid Naticas of the Inferior Oolite possess this character, but it can only be seen under certain conditions.

Var. GLOBATA. Plate XX, figs. 5 and 6.

Description:

Spiral angle	95°—100°.
Height of body-whorl to entire shell . .	75 : 100.

The chief characteristics of this variety are a more globose and sloping body-whorl, and a somewhat shorter spire. The canaliculation is but slight, and the Euspiroid character less evident. This is a case where it is not so easy to formulate a distinction between *Natica* and *Euspira*. The larger specimen (fig. 5) is from the *concavus*-bed at Bradford Abbas, where this variety occurs to some extent. The aperture is semilunar and effuse; fine lines of growth are decussated by fine spiral lines (not visible without the aid of a lens), and besides this are two or three larger lines, like undeveloped carinæ. Such globose forms seem to point somewhat in the direction of *Natica cincta*. Specimens occur more or less intermediate between the angular and globose varieties. The most globose of all are those in the Lower Trigonia-grit (fig. 6), which is probably about the same horizon as the *concavus*-bed at Bradford Abbas.

195. NATICA, cf. LORIERI, *d'Orbigny*, 1850. Plate XX, fig. 8.

1850.	NATICA LORIERI, *d'Orbigny*.	Prod., i, p. 264.
1852.	— — —	Terr. Jur., ii, p. 190, pl. cclxxxix, figs. 6, 7.

Bibliography, &c.—D'Orbigny was the first to point out that a form similar to *Natica adducta*, but more elongate and having a smaller spiral angle, occurs in the Inferior Oolite of Asnières (Sarthe) and Niort (Deux Sevres). This he called *Natica Lorieri;* it is described as having an umbilical fissure. The English specimens which I have ventured to assign to this species, either directly or as varieties, show but little trace of umbilicus. However, the mere presence or absence of an almost invisible umbilical fissure ought not to have much weight.

Description:

Spiral angle	80°.
Height of body-whorl to entire shell . .	72 : 100.
Length	25—30 mm.

Shell Euspiroid; length to width as 4 : 3; without visible umbilicus. Spire in well-marked steps; whorls of the spire (5—6) convex, narrow. Body-whorl large, angular, and mesially prominent, with some spiral lines at wide intervals, and numerous curved lines of growth. Aperture semilunar and rather effuse.

Relations and Distribution.—The points in which this form differs from *Natica adducta* are mainly those of proportions. But these differences are considerable, and correspond in the main to the differences indicated by d'Orbigny for *Natica Lorieri*. Intermediate forms connecting this with *N. adducta* occur, so that it is sometimes difficult to decide. The specimen figured is from the beds at Cold Comfort near Cheltenham. There are others from Bradford Abbas, and forms not dissimilar occur in the Inferior Oolite at Hook Norton.

Var. PROXIMA, *Hudleston*, 1882. Plate XX, fig. 7.

1882. NATICA PROXIMA, *Hudleston*. Geol. Mag., dec. 2, vol. ix, p. 200, pl. v, fig. 8.

Description:

Spiral angle	75°.
Height of the body-whorl to entire shell . .	70 : 100.

Shell oval, subumbilicate. Whorls six, regular, smooth, and slightly tumid. The sutural ledge is narrow, with only a slight canaliculation. Aperture oval; umbilical fissure distinct, with a considerable callus on the inner lip.

The presence of an umbilicus seems to connect this form more nearly with that of d'Orbigny's *Natica Lorieri* than the one last described. In this variety the whorls are less tabulate and the general outline differs.

Var. CANINA, *Hudleston*, 1882. Plate XX, figs. 9 *a*, 9 *b*, and ? fig. 1.

1882. NATICA ADDUCTA, *Phil.*, var. CANINA, *Hudleston*. Geol. Mag., dec. 2, vol. ix, p. 200, pl. v, fig. 7.

? — — — Geol. Yorks., pt. 1, pl. xi, fig. 35.

The proportions approach somewhat those of the shells referred by me to *Natica Lorieri;* but if it should turn out that d'Orbigny's name is inadmissible I would propose to call them all *Natica canina*. There is no trace of umbilicus; the mesial bulge in the body-whorl is the same as in the Cold Comfort shell, and

the aperture is very large. Under certain conditions of preservation there is a tendency to form spiral lines.

Most of the specimens in the Dogger are small; but here and there one finds fragments of a large shell which present similar peculiarities. This makes me rather disposed to consider that the very large casts which occur in the Northampton Sand (see Pl. XX, fig. 1) may be megalomorphs of *Natica canina*. The tendency to a median keel is seen even better in the cast than in the shell.

196. Natica, species or variety. Plate XX, fig. 10.

Description:

Spiral angle	70°.
Height of body-whorl to entire shell . .	65 : 100.
Length	30—35 mm.

Shell Euspiroid, oval, length to width as 1·3 : 1, traces of an umbilical fissure. Whorls about seven, square-shouldered, and deeply canaliculate, smooth, and moderately convex. Body-whorl full, yet angular, and with a slight tendency to a median keel. Lines of growth wide and rugose. Aperture semilunar with a slight incrustation on the columellar lip, and some trace of umbilicus.

Relations and Distribution.—This form constitutes a step in advance beyond the members of the *adducta*-group in the narrowing of the spiral angle coupled with a slight relative increase in the height of the spire. It is also a narrower and more elegant form than *Natica Dundriensis*, next to be described. The proportions are not far from those of *Natica Bajocensis*, but it is of larger habit, and less compressed in the body-whorl than that species. It has some resemblance to *Natica Crythea*, Laube (non d'Orb.), Die Gasteropoden des Brannen Jura von Balin, p. 4, Pl. I, fig. 6.

Two specimens are known to me; the one figured from the *Parkinsoni*-zone of Bradford Abbas, and another from the *Parkinsoni*-zone of Horton Hill. Casts which correspond fairly in size and appearance occur in the *Clypeus*-grit of Rodborough and the *Parkinsoni*-zone of Aston and Notgrove. Those from the *Clypeus*-grit have been identified by Mr. Witchell as *Natica Stricklandi*, Morris and Lycett. There are also some specimens in the Woodwardian Museum like these. Simply as a distinction I would call this *Natica* "*subelegans*."

197. Natica Dundriensis, *Tawney*, 1873. Plate XX, figs. 11 *a*, 11 *b*, 11 *c*.

1873. Euspira Dundriensis, *Tawney*. Dundry Gasteropoda, p. 7 (15), pl. i, fig. 3.
„ ? — Zelima, *d'Orb.* Tawney, op. cit., p. 6 (14), pl. i, fig. 1.

Description:

Spiral angle	75°.
Height of body-whorl to entire shell .	68 : 100.
Length	35 mm.

"Shell globose, spire somewhat elevate, apex acute; whorls six, obtusely rounded, separated by a broad, flat space at the suture, but round at the angle. Last whorl swollen, surface of shell with numerous very fine transverse lines, and a few distant obscure spiral raised lines. The test is punctate; puncta in equidistant rows. There is no umbilicus visible, the lip seems expanded over it."

Relations and Distribution.—This is sub-Euspiroid, and rather a clumsy form, the result in part of the salience of the penultimate whorl. In the young specimen (fig. 11 *c*) the system of axial and spiral lines, mentioned by Mr. Tawney, are so well preserved as to produce a complete reticulation. But this feature seems confined to specimens from Dundry where the matrix is suitable and other conditions favourable, and is most obvious in the tender young shell. Specimens from Oborne exhibit the wide-apart spiral lines, but not very clearly.

Natica Dundriensis occurs in the *Humphriesianus*-zone at Oborne and in the iron-shot Oolite at Dundry, ? also at Hook Norton. The single shell identified by Tawney as *Natica Zelima*, d'Orb., is probably an exceptionally large specimen of this species.

198. Natica Hulliana, *Lycett*, 1863. Plate XX, fig. 12.

1863. Natica Hulliana, *Lycett*. Suppl., p. 13, pl. xli, fig. 2.

Bibliography, &c.—The author says he has obtained this species in the Great Oolite of Minchinhampton and in the Inferior Oolite of the same locality. The type specimen, now refigured, is labelled "Inferior Oolite, Nailsworth." The matrix somewhat resembles the upper bed at Longfords. Mr. Witchell quotes this species from the *Clypeus*-grit.

Description.—Proportions nearly the same as in the preceding species. "Shell ovate, subglobose, smooth; volutions (six) very convex, the sutures deeply

impressed; the spire is elevated, acute, the last volution being very large; the aperture is ovate, oblique, the anterior side rounded, the posterior side acute, the length exceeding a moiety of the entire shell; the columella is rounded, thickened, and there is no umbilicus."

Relations and Distribution.—Lycett says that this species differs from *Natica intermedia* in having "a more elevated acute spire, more deeply depressed sutures, and a more globose ultimate volution." It is a more elegant shell than *Natica Dundriensis* and of smaller habit. Moreover the sutural ledge (méplat) is so narrow that the shell scarcely comes within the definition of Euspiroid; still it has a sutural ledge and not a round shoulder, and is very slightly canaliculate. The type is almost the only specimen known. I have one other from the *Parkinsoni*-zone of Lodge Hill near Castle Cary.

199. Natica Bajocensis, *d'Orbigny*, 1850. Plate XX, figs. 13 *a*, 13 *b*.

1850. Natica Bajocensis, *d'Orbigny*. Prod., i, p. 264.
1852. — — — Terr. Jur., ii, p. 189, pl. cclxxxix, figs. 1—3.
1873. Euspira Bajocensis, *d'Orbigny*. Tawney, Dundry Gasteropoda, p. 5 (13), pl. i, fig. 4.
? Syn. Natica Pictaviensis, *d'Orbigny*. Terr. Jur., ii, p. 191, pl. cclxxxix, figs. 8—10.

Bibliography, &c.—In grouping *N. Bajocensis* and *N. Pictaviensis* together we seem to ignore d'Orbigny's distinction with reference to the presence or absence of an umbilical fissure. Oppel (Juraform., p. 384) regarded the Burton Bradstock fossil as *N. Pictaviensis*. It is the exception to find an umbilical fissure in any Dorsetshire specimen. Mr. Tawney united them. It may be worth remarking here that his fig. 2 represents so abnormal a form that one would hesitate to place it under *N. Bajocensis*. Accepting the view that the numerous and well-preserved little Naticas of Burton Bradstock should be grouped under one species, the following is the diagnosis.

Description:

Spiral angle	60°—68°.
Height of body-whorl to entire shell, from .	60—63 : 100.
Length of adult individuals. . .	23—28 mm.

Shell Euspiroid, much longer than wide, oval, and usually without umbilical fissure. Spiral angle regular, apex very sharp, whorls from six to seven, smooth, slightly convex, flatted at the top, and deeply canaliculate; sutural ledge narrow. Body-whorl rather compressed. Aperture semilunar with but little callus.

Numerous lines of growth decussate with very fine spiral lines; and some specimens exhibit a spiral punctate structure. This is especially the case with specimens from the *Humphriesianus*-zone of North Dorset, where a fine reticulate structure scarcely interferes with the general smoothness of the shell.[1]

Relations and Distribution.—Although the form of this little shell is Euspiroid it is by no means clear that Lycett would have placed it under *Euspira*, because of the narrowness of the sutural ledge. Fig. 13 *a* may be taken as nearly an average specimen, inclining to be rather wide; whilst 13 *b* represents an exceptionally narrow variety, somewhat approaching *N. Calypso*, d'Orb.

This species is extremely abundant in the *Parkinsoni*-zone of South Dorset, especially at Burton Bradstock. It also occurs in the upper part of the *Humphriesianus*-zone of North Dorset, and notably in the *Cadomensis*-bed at Oborne. These specimens are for the most part wider-angled, the narrowest specimens coming from the upper part of the *Parkinsoni*-zone. *N. Bajocensis* occurs in the *Parkinsoni*-zone of Bradford Abbas, at Lodge Hill near Castle Cary, and at some other places, though not abundantly. But it may be always expected at the confines of the *Humphriesianus* and *Parkinsoni*-zones. A few typical specimens may be collected at Aston and Notgrove.

In the Cotteswolds *N. Bajocensis* appears to be partially replaced by a form nearly twice the size, but not dissimilar in proportions. It generally occurs in an imperfect condition. This is probably the form referred by Mr. Witchell to *Natica Stricklandi*, Mor. and Lyc. See remarks on No. 196.[2]

N.B.—*Natica punctura*, Bean (*pars*). See Plate XX, fig. 14.

LITTORINA PUNCTURA, *Bean*. Magazine of Natural History, vol. iii, p. 62, fig. 23.
NATICA PUNCTURA, *Bean*. Hudleston, Geol. Mag., dec. 2, vol. ix, p. 201, pl. v, fig. 10.

Shells from the Dogger thus referred exhibit a spiral angle of about 65°; ratio of the body-whorl to the full length 60 : 100, usual length 25 mm. The whorls are scarcely in steps, the sutural ledge being very narrow; the body-whorl is rather more tumid than in *N. Bajocensis*. Specimens from the Dogger are full size, and often spirally punctate (condition). Specimens from the Scarborough Limestone, when well preserved, show a fine linear spiral structure. They are usually shorter

[1] As this peculiar brown translucent calcite shows up the structure very well in other fossils we may presume that much depends upon the character of the mineraliser.

[2] Antea, p. 261.

in the spire and more tumid in the body-whorls than specimens from the Dogger. Without doubt these obscure and often ill-preserved forms are nearly related to *Natica Bajocensis*, but it would be scarcely safe to say that they are identical.

200. ? Natica (Euspira) protracta, sp. nov. Plate XX, fig. 15.

Description:

General spiral angle about . . .	50°.
Height of body-whorl to entire shell . .	55 : 100.
Length about	55 mm.

Shell thick, sub-elongate, Euspiroid, about twice as long as wide. Apex ? blunt, number of whorls ? six or seven, angular, protracted, and strongly tabulate, scarcely canaliculate. The whorls of the spire are swollen towards the centre. Body-whorl only moderately tumid, with a slight tendency towards a median keel; fine spiral lines $\frac{2}{3}$ mm. apart, decussate with curved growth-lines.

Aperture ovate-elongate, the longer diameter being slightly less than half the entire length of the shell.

Relations and Distribution.—It must be admitted that this rare form has not much the appearance of a *Natica*, though possibly, with the aid of the sub-genus *Euspira*, it may come to be regarded as one of the Naticidæ. It has a certain degree of resemblance to *Pseudomelania*, but against this view we must place the relative size of the aperture, and also the fine and curved, rather than sinuous, growth-lines. There is just the possibility that these shells represent a diseased or abnormal growth of some other species, though what that species may have been it is by no means easy to indicate.

Two specimens are in my collection; these are believed to have come from the *Parkinsoni*-zone of Bradford Abbas.

201. Natica canaliculata, *Morris* and *Lycett*, 1851. Plate XX, fig. 16.

1851. Euspira canaliculata, *Morris and Lycett*. Great Ool. Moll., part i, p. 45, pl. xi, fig. 23.
Natica (Euspira) canaliculata, *Morris and Lycett*. In the Explanation of pl. xi.

Bibliography, &c.—The authors observe that several specimens have been extracted from the limestone beds of the Great Oolite, but that it is much more common in the middle beds of the Inferior Oolite in Gloucestershire. Having never been able to see any specimens of *Euspira canaliculata* from the Great

Oolite, I lately proceeded to examine the type at the Jermyn Street Museum. This was the only specimen in the Great Oolite Collection, and a careful examination showed that this was most probably from the Pisolite of Longfords, and consequently an Inferior Oolite specimen. There is no evidence to my knowledge that *Euspira canaliculata* ever occurs in the Great Oolite of this country, though a micromorph, *Euspira subcaniculata*, Morris and Lycett, is occasionally found in that series.

Description:

Spiral angle	96°.
Height of body-whorl to entire shell . .	74 : 100.
Length about	30 mm.

The following is the authors' diagnosis: "Shell oblong, spire but little elevated, apex acute, whorls angulated, the angles acute, the upper portion of the whorls deeply channeled, their lower portions rather convex, the last whorl oblique, its base attenuated; aperture elliptical, the umbilical fissure narrow. Several obscure encircling lines may be traced upon the middle of the last whorl."

Relations and Distribution.—Since this species is put forwards by the authors in the front rank of the sub-genus *Euspira*, it becomes necessary to study it with special attention, and all the more so as there is every reason to believe that it is an exclusively Inferior Oolite species. There can be little doubt that *Natica* (*Euspira*) *canaliculata* is first cousin to the typical form of *Natica adducta*, from which it mainly differs in the greater width of the sutural ledge, or "méplat." There are, in fact, forms in the Dogger which seem to connect the two. The group to which *Natica Pelops*, *Natica Oppelensis*, *Natica adducta*, and *Natica canaliculata* belong have the following elements in common, viz. a spiral angle, which is a right angle or slightly in excess, a body-whorl about seven-tenths the total height, and very square-shouldered whorls.

Specimens with a sutural ledge almost as broad as in the type occur in the Dogger, but the species is most abundant and most typically developed in certain beds of the Inferior Oolite in Gloucestershire.

202. Natica cincta, *Phillips*, 1829. Plate XX, fig. 17; Plate XXI, figs. 3 and 4.

1829 and 1835. Natica cincta, *Phil.* Geol. Yorks., pt. 1, pl. iv, fig. 9, p. 101.
1853. — Leckhamptonensis, *Lycett.* Proc. Cottesw. Nat. Club, vol. i, p. 77.
1854. — cincta, *Phil.* = Natica Leckhamptonensis, *Lycett.* Morr. Cat., p. 262.
1882. — — *Phil.* Hudleston, Geol. Mag., dec. 2, vol. ix, p, 197, pl. v, fig. 4.

Bibliography, &c.—This remarkable shell was first figured by Phillips, without a description, as from the Coralline Oolite of Malton, along with "*Echinus*" *germinans* and "*Clypeus*" *semisulcatus*. The distinction between the Coralline Oolite of the Malton district, and the Inferior Oolite of the Castle-Howard district was not made known in those early days. The type is at Leeds.

The Rev. P. B. Brodie, in a paper "On the Geology of the Neighbourhood of Grantham,"[1] speaks of a very large *Natica* characteristic of the Inferior Oolite of Denton, of which casts only were known. This was described by Lycett as a new species under the title of *N. Leckhamptonensis*, with the following diagnosis: "Spire elevated, whorls convex, the last enormously expanded, upper surface of the whorls rounded and sulcated; aperture very effuse, orbicular. Only casts known. A gigantic species."

In 1854 Morris, with his usual sagacity, perceived the close connection between *N. cincta*, Phil., and *N. Leckhamptonensis*, Lyc., but, misled by Phillips, quotes it from the Coralline Oolite. Moreover, under the then prevailing impression that the Denton Limestone was Great Oolite (contrary to the opinion expressed by Brodie) he quotes it from the "Great Oolite" of Lincolnshire, as well as from the Inferior Oolite of Gloucestershire.

Description:

Spiral angle	115°—120°.
Height of body-whorl to entire shell . .	80 : 100.
Length about	100 mm.

N.B.—The largest specimen known measures: Length, 116 mm.; width, 110 mm.

Shell globosely angular, thick, nearly as wide as long, spire rather short, sub-euspiroid, apex probably blunt. Whorls (4—5) increase with great rapidity, causing an enormous expansion of the body-whorl. Sutural ledge very wide, and sloping downwards, so as to produce an inclined tabulate surface, which rises slightly to meet the keel at the angle of the whorl; only canaliculate in the early stage.

Body-whorl extremely ventricose, often richly marked by broad and curved lines of growth, and sometimes showing a kind of spiral line towards the middle. Aperture very effuse, hardly any sign of umbilicus, the shell-substance being very thick in this region (20 mm. in the type specimen).

Varieties or Stages of Growth.—The figure (Pl. XX, fig. 17) represents a small fossil such as may occasionally be found in the Oolite Marl, where casts of *Natica cincta* are fairly numerous. The proportions are almost exactly those of *Natica cincta*. It is more canaliculate than mature specimens of that species.

The largest specimen of *Natica cincta* known was found in a pale chalky-look-

[1] 'Proc. Cottesw. Nat. Club,' vol. i, p. 56.

ing limestone at North Luffenham (Rutland). Remains of spiral ornamentation decussating with growth-lines are very conspicuous on portions of the sloping ledge or shoulder of the body-whorl. This suggests a kind of ornamentation not dissimilar to that of *Sigaretus*.

Relations and Distribution.—The tabulate character of the whorls and step-like spire serve to connect this species with *Euspira*. Probably *Euspira canaliculata* must be regarded as its nearest relative. The low spire, wide ledge and angular, yet tumid body-whorl are points of resemblance. On the other hand the ledge or shoulder, instead of being canaliculate, slopes outwards, the spiral angle is considerably wider, and the habit of the species much larger. Indeed the great size of *Natica cincta*, in view of the fact that all other Inferior Oolite Naticas in this country are of modest dimensions, is a phenomenon of much interest, which becomes emphasised by the fact that this big shell appears entirely confined to the horizon of the Oolite Marl and its equivalents.

Commencing in the north, this species, as we have seen, was first noticed in the Inferior Oolite Limestone of the Castle Howard district, which is generally admitted to be on the horizon of the Lincolnshire Limestone. Casts are abundant in the lower part of the latter series, though the connection of these corkscrew-like forms with *Natica cincta* is not always so evident, until we bear in mind the enormous thickness of this shell, especially in the umbilical region. *Natica cincta* is not found in the upper beds of the Lincolnshire Limestone at Weldon and Great Ponton. The best specimens are from Coombe Hill near Deddington (North Oxfordshire), where it occurs with *Ammonites Murchisonæ*, *Terebratula fimbria*, and *Spiropora straminea*.[1] The next place where we meet with *Natica cincta* in any quantity is in the railway-cutting through the Oolite Marl at Notgrove (between Bourton and Cheltenham). In specimens from this locality a considerable portion of the shell is apt to remain on the spire, so that we rarely get the corkscrew-like forms which are characteristic of the Lincolnshire Limestone at Denton and elsewhere. The casts which suggested the name *Leckhamptonensis* were most likely from the Oolite Marl of the Cotteswold escarpment. The shell quoted by Witchell ('Geology of Stroud,' p. 50) from the Oolite Marl as *Natica macrostoma*, Röm., is most probably *Natica cincta*.

No such species as *Natica cincta* has yet been discovered in Dorsetshire, but the form described by me as *N. adducta* var. *globata* (Pl. XX, fig. 5) presents some points of resemblance.

[1] Judd, 'Geology of Rutland,' pp. 25—27.

Section B.—Mammillated.

203. Natica cf. Michelini, *d'Archiac*, 1843. Plate XX, figs. 18 *a*, 18 *b*.

1843.	Natica Michelini, *d'Archiac*.			Mém. Soc. Géol. France, vol. v, 2nd part, p. 377, pl. xxx, fig. 1.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., part i, p. 44, pl. vi, fig. 3 (*non* fig. 2).
1852.	—	—	—	D'Orbigny, Terr. Jur., ii, p. 192, pl. cclxxxix, figs. 11, 12.
1884.	Ampullina Michelini, *d'Archiac*.			Cossmann, Ét. Bath., p. 131, pl. ii, figs. 9, 10.

Bibliography, &c.—D'Archiac's diagnosis is repeated by d'Orbigny. The shell is described as thick, ovoid, and with a very sharp spire, apex mammillated; seven whorls, the last very enveloping, and depressed near the suture.

Morris and Lycett described what they regarded as two varieties. Of these the longer and commoner form has only a faint degree of resemblance to d'Archiac's figure. Hence de Loriol (*fide* Cossmann, *loc. cit.*) has renamed this form *Natica Minchinhamptonensis* ('Alpes Vaud.,' p. 13, pl. i, figs. 8, 9).

The Inferior Oolite variety to which I now call attention has much more resemblance to d'Archiac's species than the Minchinhampton shell renamed by de Loriol, but it presents also considerable differences.

Description of Inferior Oolite Variety:

Spiral angle	106°.
Height of body-whorl to entire length . .	85 : 100.
Length of figured specimen . . .	31 mm.

The points wherein this form differs materially from *Natica Michelini* are—it is narrower, the shoulder is less sloping, and the body-whorl is less globose. There are other differences such as absence of callus on the inner lip, &c., which may possibly be due to conditions of preservation. There is no visible umbilicus.

Relations and Distribution.—This form almost stands alone in the Inferior Oolite. The very effuse aperture also serves to distinguish it from all other species except *Natica cincta*. In the Northampton Sand are casts of a very large *Natica*, which is closely related, possibly identical. A few specimens are known from the Oolite Marl of the Stroud-Nailsworth district; and there is a specimen, 45 mm. long, in Mr. Walford's collection from the Gryphite-grit of Bourton-on-the-Water which might be assigned to this variety of *Natica Michelini*.

There are some very small specimens from the Oolite Marl which might be regarded as micromorphs of *Natica Verneuili*, d'Arch., or of some closely-related species. These I have not ventured to figure.

204. ? Euspira species. Plate XXI, fig. 2.

Cf. *Euspira coronata*, Morris and Lycett, ' Great Ool. Moll.,' part 1, page 46, plate vi, fig. 9.

Bibliography, &c.—The authors admit that *Euspira coronata* may be regarded as an aberrant form of *Euspira* in which the carina becomes nodulous. But in reality there is no median carina on the body-whorl of any of the species described by those authors from the Great Oolite or the Inferior Oolite, such as *E. canaliculata*, *E. Sharpei*, *E. pyramidata*, or *E. subcanaliculata*. Moreover these species show hardly any trace of umbilicus, whereas "*Euspira*" *coronata* is largely umbilicated. Thus "*Euspira*" *coronata* can scarcely be classified with the other *Euspiræ* of Morris and Lycett, which are in facts Naticas, or, as our French contemporaries would say, Ampullinas. The type, which may be seen at the Jermyn Street Museum, is in excellent preservation, and appears to be unique. Its authenticity as a Great Oolite specimen seems beyond question.

The above remarks are made in consequence of the discovery in Mr. Crick's Collection of a fossil from the Northampton Sand of which the following is a

Description:

Spiral angle	70°.
Height of body-whorl to entire shell . .	65 : 100.
Length	29 mm.

Shell globosely conical, turrited, umbilicated; apex sharp. The whorls of the spire (four or five) are angulated, flat or slightly concave, arranged in steps or ledges, and ornamented with a nodulous carina which forms the angle of each whorl; sutures close.

The body-whorl, which occupies between six and seven-tenths of the total height of the shell, is largely expanded and flattened posteriorly; it is ornamented by two conspicuous and nodulous keels, the upper one at the angle of the whorl, the lower one about halfway between the suture and the extremity of the rounded base; between the keels the whorl is constricted. Aperture wide and semilunar, the outer lip slightly angulated; a considerable umbilical cavity is exposed, but this portion of the specimen is much corroded.

Relations, &c.—Differs from "*Euspira*" *coronata* in having a relatively longer spire, but chiefly in the different position of the anterior keel, which changes the form of the shell materially. I would distinguish it for the present as "*Euspira*" *subcoronata*. Occurs in the Northampton Sand, Old Duston.

Family—RISSOIIDÆ.

"*Shell usually small, turbinate; aperture oval or semilunar, entire or subcanaliculate at the base, peristome continuous; operculum horny.*"—FISCHER.

Genus—RISSOA, Fréminville, 1814.

"*Shell imperforate or subperforate, more or less oblong, turbinate; aperture scarcely oblique, oval, entire; peristome simple or reflected.*"—FISCHER.

This genus can scarcely be regarded as occurring in the Inferior Oolite, although ? *Rissoa lævis*, Sow., has been quoted from the Cotteswolds by Lycett (Proc. Cottesw. Nat. Club, vol. i, p. 72). There is a smooth species found in the Lincolnshire Limestone at Weldon, which might at first sight be taken for *Rissoa lævis*, Sow., but which has been described under *Rissoina*.

Genus—RISSOINA, *d'Orbigny*, 1840 ?.

"*Shell turrited, whorls numerous, but slightly convex; apex mammillated; aperture oval, semilunar; lip thickened internally, slightly reflected, canaliculate or subcanaliculate in front; operculum horny.*"—FISCHER.

The distribution of *Rissoina* in the Inferior Oolite is very local, and mainly confined to the upper beds of the Lincolnshire Limestone. A few obscure fragments have been found in the Lower Limestone (Witchell) of the Cotteswolds, and better preserved specimens are occasionally obtained from the Pea-grit. These are the earliest recognisable forms hitherto noted from the British Jurassics.

The prevailing form of *Rissoina* in the Lincolnshire Limestone is *R. obliquata* Sow., or some of its varieties. This form Mons. Cossmann unites with *R. acuta*, Sow., retaining the name *acuta* for the species. There are specimens both from the Pea-grit of the Cotteswolds, and also from the Lincolnshire Limestone at Weldon, which answer fairly well to Sowerby's description of *R. acuta*, having the slender spire and straight ribs of that species, but they seem to run into *R. obliquata*, which is certainly the more abundant form. This latter may be divided into more than one variety. Taking this view of the case, I recognise three

species of *Rissoina* in the Inferior Oolite, viz. *R. obliquata*, Sow., with varieties; *R. obtusa*, Lycett; and *R. gymnoides*, sp. nov.[1]

205. Rissoina obliquata, *Sowerby*, 1829. Plate XXI, fig. 7; var. *parcicostata*, fig. 8—? var. fig. 9.

1829. Rissoina obliquata, *Sowerby*. Min. Conch., pl. dcix, fig. 3.
1851. — — *Morris and Lycett*. Great Ool. Moll., part i, p. 52, pl. ix, fig. 19.
1852. — "duplicata," *d'Orbigny*. Terr. Jurass., vol. ii, pl. ccxxxvii, figs. 1—3.

Bibliography, &c.—Originally described by Sowerby from the Great Oolite of Ancliff, together with *R. acuta* and *R. duplicata*. Morris and Lycett speak of it as rare in the Great Oolite of Minchinhampton. D'Orbigny's figure named "*duplicata*" is not at all like Sowerby's *R. duplicata*. The artist seems to have got hold of *R. obliquata* by mistake.

Description:

Length about	6 mm.
Length to width as . . .	1 : 0·45.
Spiral angle (obtuse) about . . .	28°.

Shell turrited, subelongate, turbinate, often twisted. Whorls about seven, tumid, close, and costated; the costæ (about twelve in each whorl) are prominent, and curve with a slope from right to left. Aperture restricted, ovate posteriorly, flattened and subcanaliculate in front; lips much thickened.

Relations and Distribution.—As compared with *R. acuta* this species is wider and stouter, the whorls are more tumid, and the costæ usually more prominent; in the varieties they are fewer in number. It has a considerable resemblance to the existing *R. costata*. The typical form is fairly plentiful at Weldon.

Var. *parcicostata* (fig. 8). This is a still more stumpy form; the costæ are fewer in number, prominent, and less curved. This variety prevails at Great Ponton. Micromorphs occur there and in the Scarborough Limestone.

Variety or sport (fig. 9). The points wherein *R. obliquata* differs from *R. acuta* become intensified in this form, which is extremely stumpy and very coarsely ribbed. It has a length of 6 mm. and a spiral angle of about 40°. The aperture is strongly canaliculate anteriorly.

A single specimen in the Sharp collection at the British Museum. We might call this *R. obliquata*, var. "*inflata*," or simply *Rissoina* "*inflata*."

[1] *Rissoina cancellata*, Morris and Lycett, is quoted from the shelly beds of Ponton (Morris, 'Quart. Journ. Geol. Soc.,' vol. ix, p. 326), but I can find no confirmation of this.

PLATE XVII.

Fig.

1 *a*. *Turritella Dorsetensis*, sp. nov. Irony-nodule bed, Burton Bradstock. My Collection.

1 *b*. Variety of the same. *Murchisonæ*-zone, Bradford Abbas. My Collection.

1 *c*. *Turritella Dorsetensis*. Composite figure drawn from three specimens; the apical and anterior portions from the irony-nodule bed, Burton Bradstock; median portion from the *Murchisonæ*-zone, Stoford. My Collection. (Page 228.)

2 *a*. *Turritella* (*Mathilda*) *abbas*, sp. nov. 2 *b*. The same, apical condition. 2 *c*. Variety of the same. All from the *concavus*-bed, Bradford Abbas. My Collection. (Page 230.)

3 *a*. *Turritella* (*Mathilda*) *opalina*, Quenstedt. *Concavus*-bed, Bradford Abbas. 3 *b*. Variety of the same, approaching var. *canina*. *Murchisonæ*-zone, Stoford. Both in my Collection. (Page 231.)

4. *Turritella* (*Mathilda*) *opalina*, var. *canina*, Hudleston. Dogger, Blue Wyke. British Museum. (Page 232.)

5. *Turritella* (*Mathilda*) *strangulata*, sp. nov. *Concavus*-bed, Bradford Abbas. My Collection. (Page 233.)

6. *Turritella* (*Mathilda*) *quadrivittata*, Phillips. Dogger, Blue Wyke. My Collection. (Page 233.)

7. *Turritella* (*Mathilda*), cf. *binaria*, Héb. and Desl. Neighbourhood of Beaminster. My Collection. (Page 234.)

8.[1] *Cerithinella cingenda*, Sowerby. Dogger, Blue Wyke. British Museum.

9. *Pseudomelania procera*, var. *minor*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 238.)

x. *Mathilda*, cf. *euglypha*, Laube. Upper Lias, Heyford. Crick Collection. Magnified; apex largely magnified. (Footnote, page 235.)

N.B.—All other species figured in this plate are natural size, with one whorl enlarged.

[1] Possibly the type-specimen of *Turritella cingenda*, Sow. Subsequently this was regarded as a *Nerinæa* (*vide* Hudleston, 'Geol. Mag.,' dec. 3, vol. i (1884), p. 112, pl. iv, fig. 9). For an account of *Cerithinella* see p. 186 of the present work.

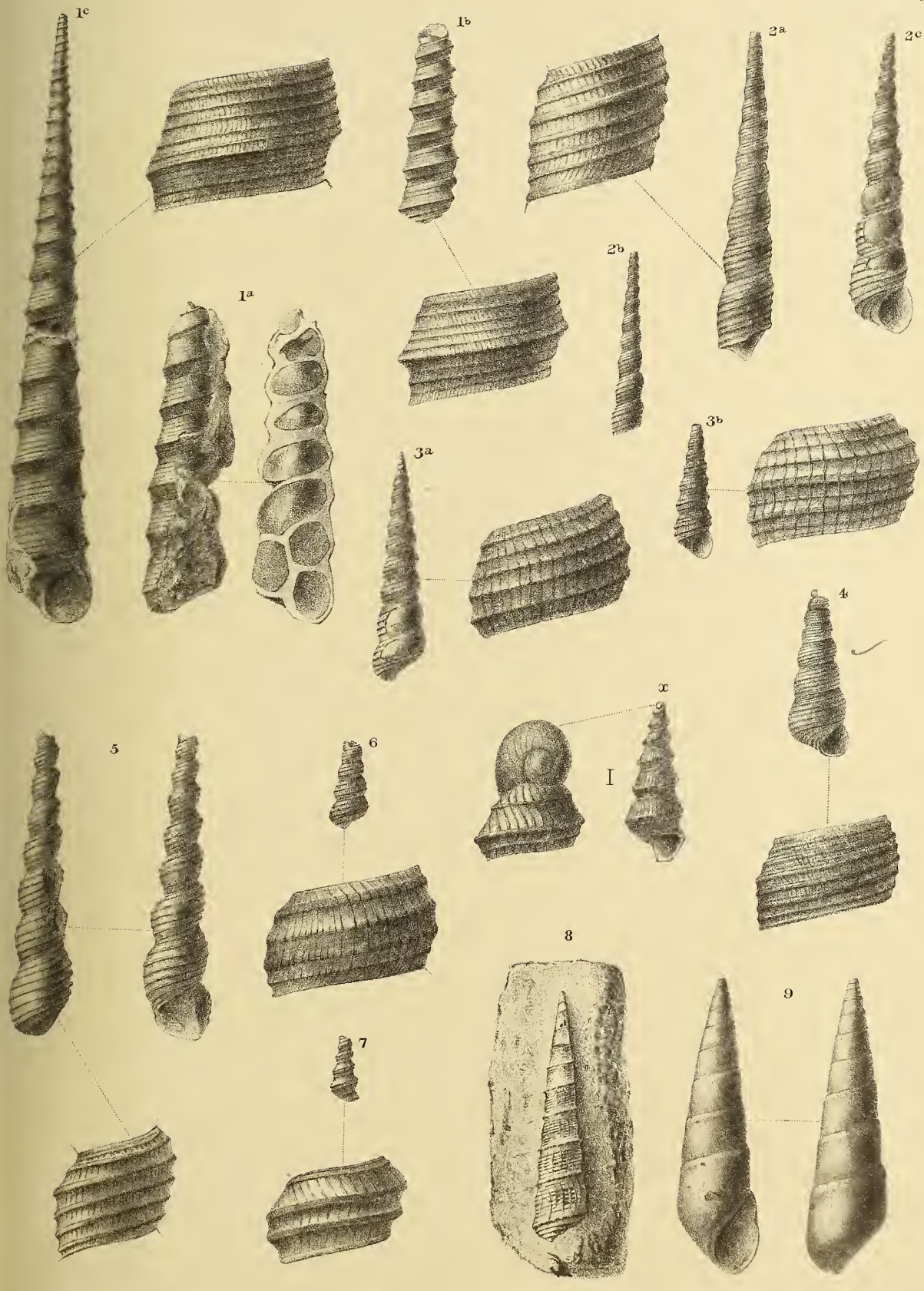

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PLATE XVIII.

Fig.

1. *Pseudomelania procera*, Deslongchamps. *Murchisonæ*-zone, Bradford Abbas. My Collection (Buckman[1]). (Page 237.)

2. The same (*lineata-procera*). Dogger, Blue Wyke. Leckenby Collection.

3 *a*. *Pseudomelania bicarinata*, Wright, MS. *Concavus*-bed, Bradford Abbas. 3 *b*. Young specimen; same horizon and locality. Both from my Collection (Stephens[1]). (Page 238.)

3 *c*. *Pseudomelania bicarinata*. *Opalinus*-zone, Burton Bradstock. My Collection.

4 *a*. *Pseudomelania heterocycla*, Eugène Deslongchamps. *Concavus*-bed, Bradford Abbas. 4 *b*. The same. *Murchisonæ*-zone, Stoford. Both from my Collection. (Page 239.)

4 *c*. *Pseudomelania heterocycla*. Specimen from Coker (*Murchisonæ*-zone). British Museum.

5. *Pseudomelania* "*robusta*." *Opalinus*-zone (*Moorei*-beds), Coaley Peak. My Collection (Buckman). (Page 240.)

6. *Pseudomelania* "*pinquis*." *Murchisonæ*-zone, Coker. My Collection. (Page 240.)

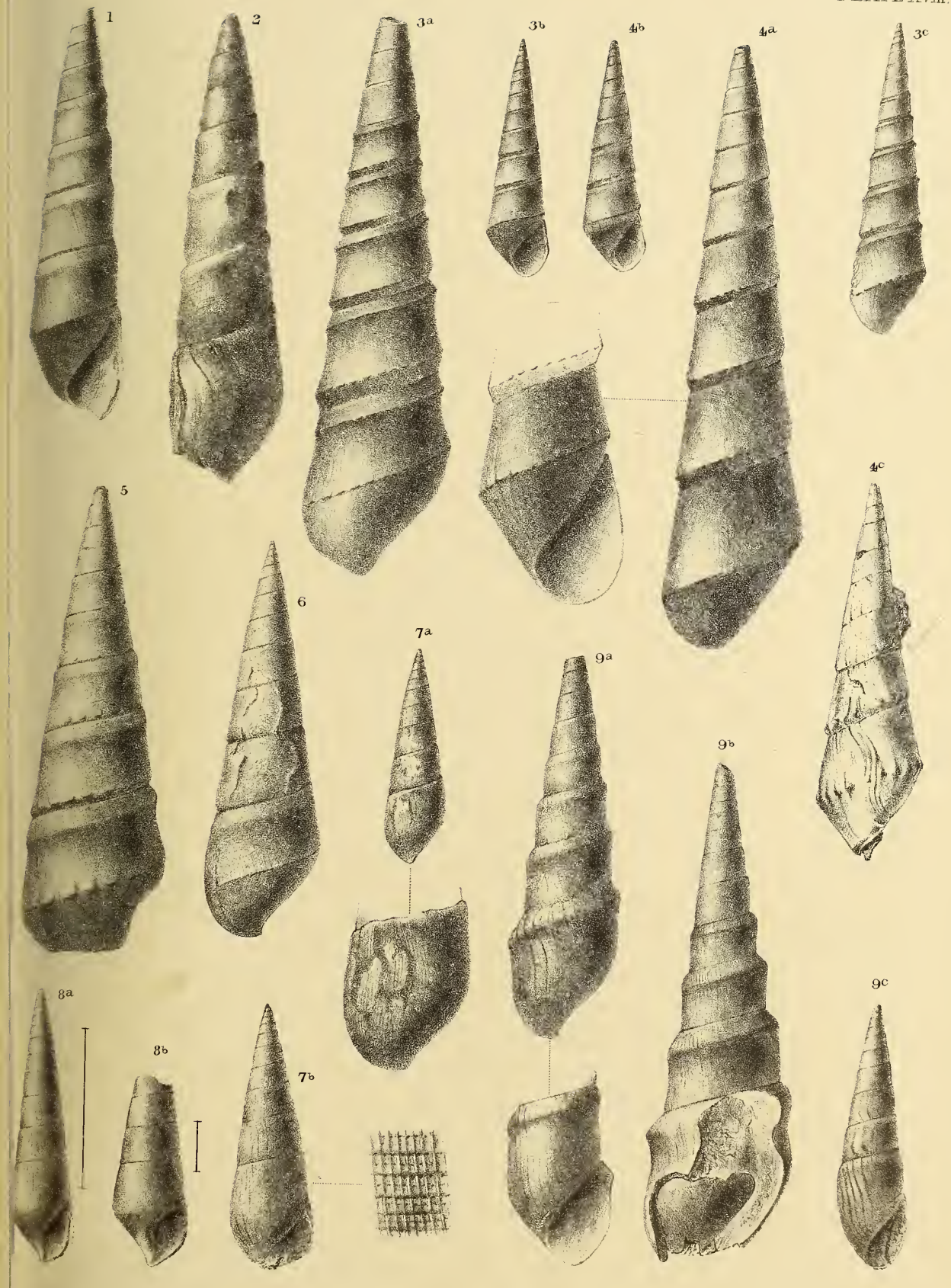
7 *a*. *Pseudomelania lineata*, Sowerby; variety approaching *P. Normaniana*, d'Orb. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 241.)

7 *b*. *Pseudomelania lineata*. Specimen showing spiral puncta. Locality unknown. My Collection.

8 *a*. *Pseudomelania Astonensis*, sp. nov. *Parkinsoni*-zone, Aston cutting. My Collection. 8 *b*. The same. Lincolnshire Limestone. British Museum. (Page 245.)

9 *a*, 9 *b*, 9 *c*. *Pseudomelania coarctata*, Deslongchamps. Three specimens showing different stages of development. *Cadomensis*-bed (upper part of *Humphriesianus*-zone), Oborne. My Collection. (Page 242.)

[1] These names indicate the source from which the specimen was obtained.



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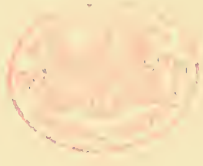


PLATE XIX.

Fig.

1 *a*. *Pseudomelania coarctata*, Deslongchamps. Variety from *Humphriesianus*-zone, Oborne, showing resemblance to *Ps. Lonsdalei*. My Collection. (Page 242.)

1 *b*. *Pseudomelania*, near to *coarctata*, Desl., also showing some affinity with *Ps. Lonsdalei*. *Clypeus*-grit, Nailsworth Hill. My Collection. (Page 243.)

2. *Pseudomelania Lonsdalei*, Morris and Lycett. Scarborough Limestone, Pickering Cliff. My Collection. (Page 243.)

3. *Pseudomelania ? Scarburgensis*, Morris and Lycett. Scarborough Limestone. Leckenby Collection. (Page 243.)

4. *Pseudomelania simplex*, Morris and Lycett. Cotteswolds (? Oolite Marl). My Collection (Wright). (Page 244.)

5. *Pseudomelania Burtonensis*, sp. nov. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 246.)

6. *Pseudomelania*, species (accidentally introduced).

7 *a*. *Cloughtonia cincta*, Phillips. Lincolnshire Limestone, Weldon. 7 *b*. The same. Scarborough Limestone, Cloughton Wyke. Both from my Collection. (Page 247.)

8. *Bourguetia striata*, Sowerby ; wide and conical form. *Murchisonæ*-zone, Halfway House. My Collection (Buckman). 9. The same (narrow and pupoid form). *Murchisonæ*-zone, Bradford Abbas. My Collection (Stephens). N.B.—Both these belong to the local variety *multistriata*. (Page 249.)

10 *a*. "*Phasianella*" *latiuscula*, Morris and Lycett. Lincolnshire Limestone, Weldon. 10 *b*. ? The same, small variety. Bradford Abbas. My Collection. (Page 251.)

11 *a*. "*Phasianella*" *elegans*, Morris and Lycett. Specimen showing punctate structure. Lincolnshire Limestone. Jermyn Street Museum. (Page 252.)

11 *b*. "*Phasianella*" *elegans*, Morris and Lycett. Barnack Rag (Lincolnshire Limestone). British Museum.

12. "*Phasianella*" *elegans*, Morris and Lycett. Narrow variety. Lincolnshire Limestone, Great Ponton. My Collection.

13. "*Phasianella*" *Pontonis*, Lycett. Barnack Rag. British Museum. (Page 253.)

14 *a*. "*Phasianella*" *conoidea*, sp. nov. Scarborough Limestone. My Collection. (Page 254.)

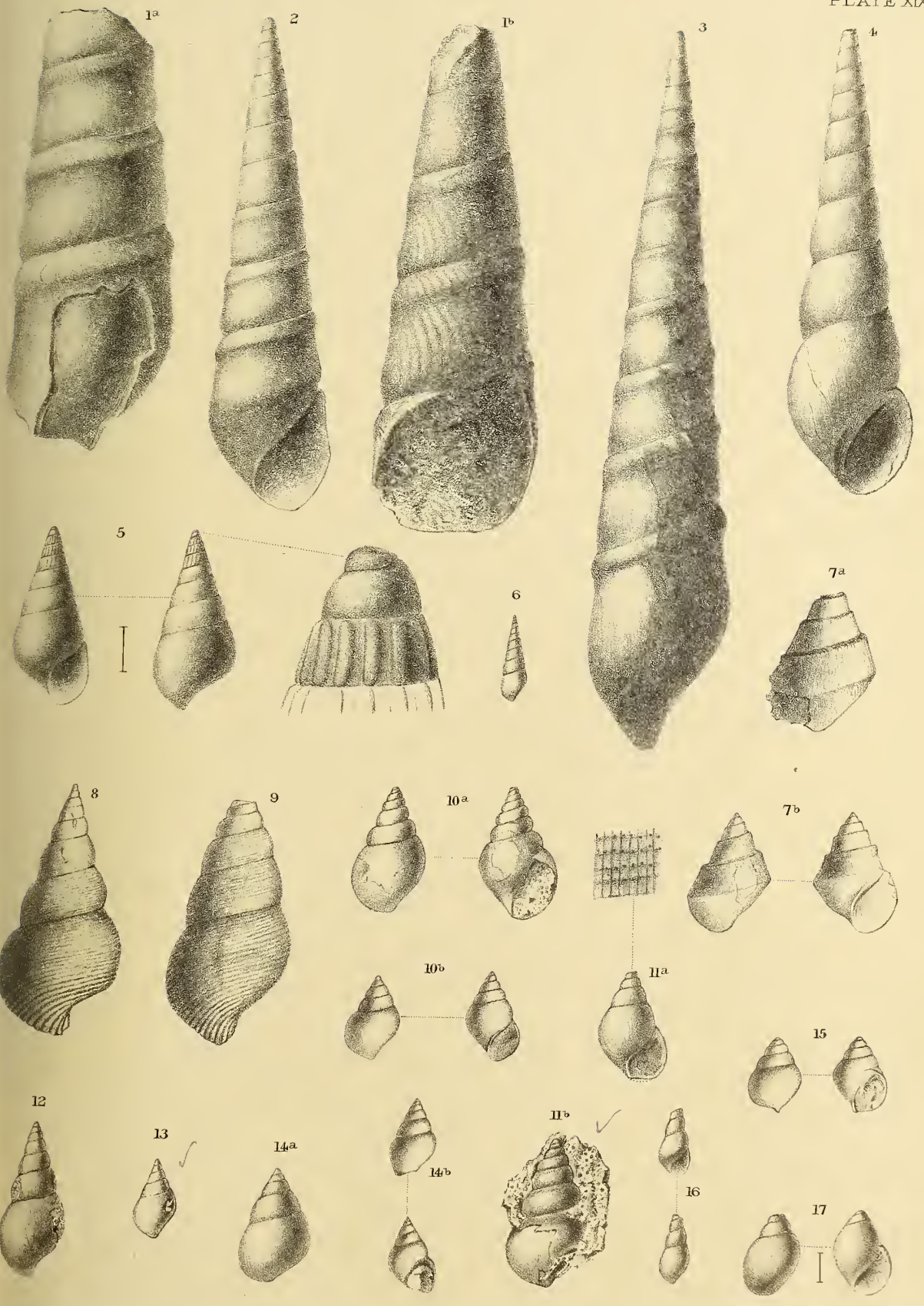
14 *b*. "*Phasianella*" *? elegans*, Morris and Lycett. Small specimen. *Parkinsoni*-zone, Stoford. My Collection (Buckman).

15. "*Phasianella*," cf. *subumbilicata*, d'Archiac. Lincolnshire Limestone, Weldon. My Collection. (Page 255.)

16. *? Pseudomelania*, species. Oolite Marl, Nailsworth. My Collection. (Page 244.)

17. "*Phasianella*," cf. *nuciformis*, Morris and Lycett. Lincolnshire Limestone, Weldon. My Collection. (Page 255.)

All figures natural size except Figs. 5 and 17.



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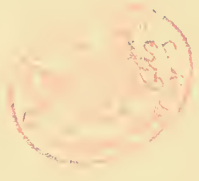


PLATE XX.

Natica, section A. = Euspira in part.

Fig.

1. *Natica*, species (cast). Northampton Sand, Duston. British Museum. (Page 261.)
2. *Natica adducta*, Phillips, var. *Oppelensis*, Lycett. Cotteswold Sands, Nailsworth. Jermyn Street Museum. Type. (Page 258.)
3. *Natica adducta*, Phillips. Dogger, Blue Wyke. Scarborough Museum. (Page 257.)
4. The same. Pea-grit, Leckhampton. My Collection.
5. *Natica adducta*, Phil., var. *globata*. *Concavus*-bed, Bradford Abbas. My Collection. (Page 259.)
6. The same. Lower Trigonia grit, Leckhampton. Jermyn Street Museum.
7. *Natica proxima*, Hudleston (var. of *Natica Lorieri*). Dogger, Blue Wyke. Woodwardian Museum. (Page 260.)
8. *Natica*, cf. *Lorieri*, d'Orbigny. Cold Comfort, near Cheltenham. My Collection. (Page 259.)

9 *a*. *Natica Lorieri*, d'Orb., var. *canina*, Hudleston. Dogger, Blue Wyke, Woodwardian Museum. 9 *b*. Another specimen. Dogger, Blue Wyke. My Collection. (Page 260.)

10. *Natica* "*subelegans*." *Parkinsoni*-zone, Bradford Abbas district. My Collection (Buckman). (Page 261.)

11 *a*. *Natica Dundriensis*, Tawney. Base of *Humphriesianus*-zone, Oborne. My Collection (Buckman). 11 *b*, 11 *c*. Specimens of *Natica Dundriensis* from the iron-shot Oolite of Dundry showing reticulate structure. Woodwardian Museum. (Page 262.)

12. *Natica Hulliana*, Lycett. Nailsworth. Jermyn Street Museum. Type. (Page 262.)

13 *a*. *Natica Bajocensis*, d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. 13 *b*. Another specimen (narrower variety, approaching *N. Calypso*, d'Orb.) *Parkinsoni*-zone, South Dorset. Both from my Collection. (Page 263.)

14. *Natica* "*punctura*," Bean. Dogger variety (*? N. Bajocensis*). Blue Wyke. Woodwardian Museum. (Page 264.)

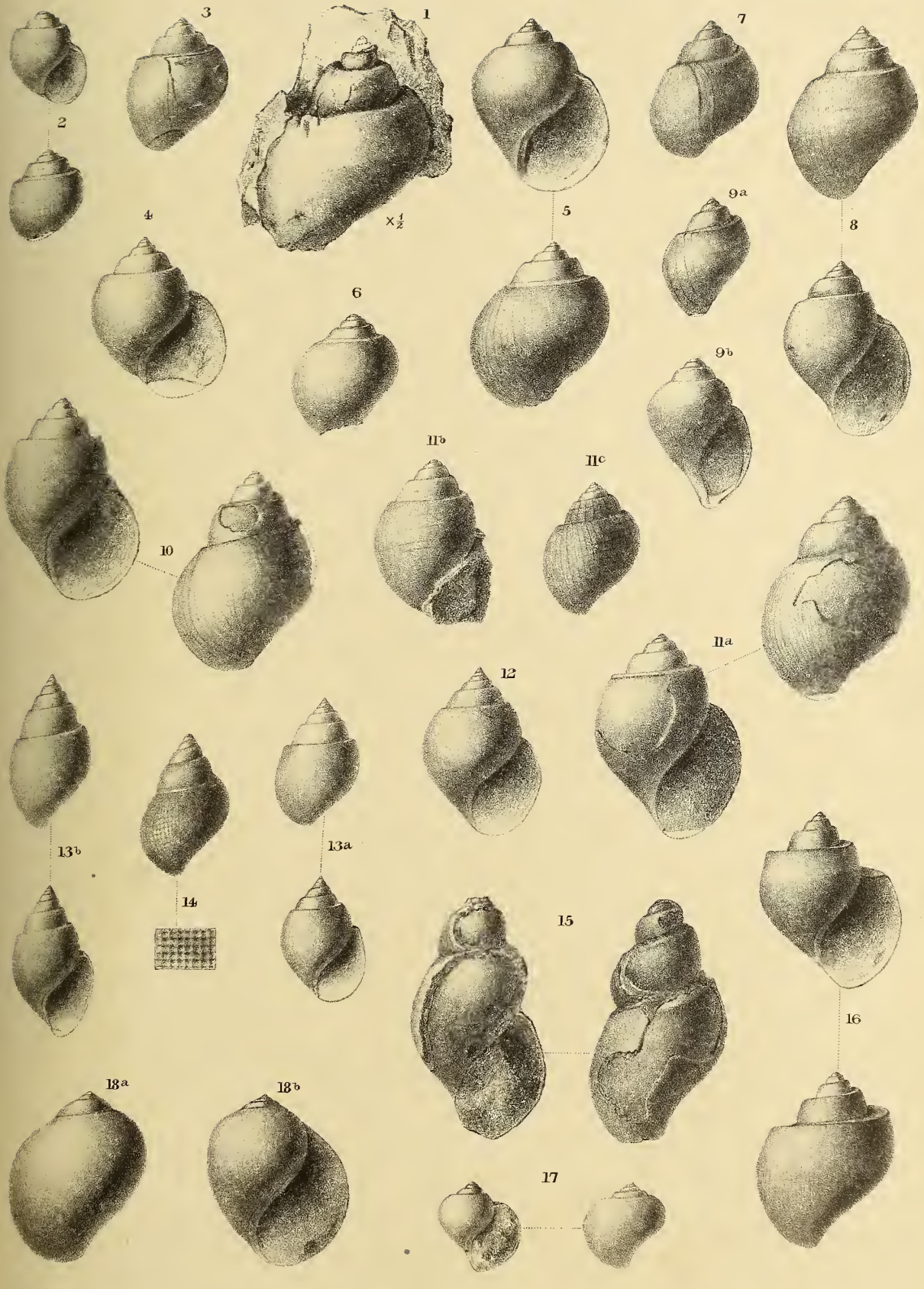
15. *Natica protracta*, sp. nov. *Parkinsoni*-zone, Bradford Abbas. My Collection (Buckman). (Page 265.)

16. *Natica canaliculata*, Morris and Lycett. Upper Pisolite, Longfords. My Collection. (Page 265.)

17. *? Natica cincta*, Phillips. Young specimen Oolite Marl, Leckhampton. Jermyn Street Museum. For adult specimens see Plate XXI, figs. 3 and 4. (Page 266.)

Natica, section B. = Mammillated.

18 *a*, 18 *b*. *Natica*, cf. *Michelini*, d'Archiac. Two specimens, Inferior Oolite, Nailsworth. Jermyn Street Museum. (Page 269.)



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